AN OGDEN PUBLICATION DEVOTED TO GLASS TECHNOLOGY, ENGINEERING, MATERIALS AND GLASS FACTORY EQUIPMENT AND OPERATION

the glass industry

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The GLASS INDUSTRY, Vol. 37, No. 1, January, 1956, Published monthly by Ogden Publishing Company, 55 West 42nd Street, New York 36, N. Y. Subscription $4.00 a year. Canada and foreign, $5.00. Single copies 40 cents domestic, 60 cents Canada and Foreign. Issues over three months old 60 cents; over one year, $1.00. Second class mail privileges authorized at New York, N. Y.

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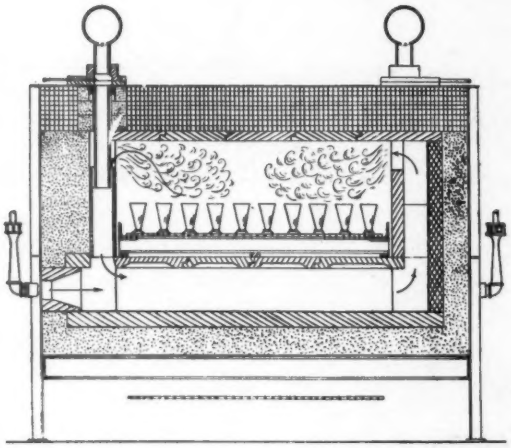

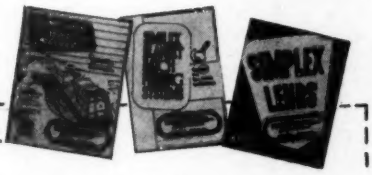

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the glass industry
VOLUME 37, NUMBER 1, JANUARY, 1956

The Glass Industry—1955

By H. E. SIMPSON
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I. Introduction

The glass industry continues to grow, expand and develop more versatile and useful products. The year 1955 has been one of record production in the flat glass and container fields and one of continued expansion in the field of glass fibers. In order to answer the demands for flat glass one company is spending 25 million dollars for improvements and expansion of its productive capacity, while another is spending 34 million dollars for a new plate glass plant. A new window glass plant in the midwest is also contemplated.

Owens-Illinois Glass Company dedicated a magnificent 8 million dollar Technical Center in Toledo, Ohio, in the fall of 1955. This company has assembled in a three-story structure, comprising 200,000 square feet, the most modern laboratory and pilot-plant equipment yet known for both fundamental and applied research in all phases of glass technology. In all, some 500 scientists and technicians are engaged in research and development work designed to provide the best in glass.

It is of interest to note that the year 1955 marks the 50th anniversary of the first safety glass patents, although the early development was almost negligible until about 1913. Now safety glass is available for aircraft glazing to successfully protect high-speed supersonic aircraft.

The sale of electronic equipment continues to grow, and color television is beginning to expand as various technical difficulties are surmounted. The industry faces a most optimistic future with expected continued demands for its products. Production should not suffer because the capacity to produce is very high.

II. Flat Glass

The flat glass industry—both drawn and ground—and polished plate glass have had a record breaking year. This peak production has been due to heavy automobile production (over 9.0 million cars), large building operations, and very good business in such items as furniture, mirrors, and industrial glass.

Plant Expansion

Because of the increased demands for flat glass (some have estimated this to be as high as 40% in the automobile glazing field alone), one major company is spending 25 million dollars for expansion and improvements in existing plants. Two new 1,100-ton continuous melting tanks are under construction, and one will be ready to operate early in 1956. Another significant expansion in the same company is the construction of a fourth grinding and polishing line. Further, there is under construction an addition, increasing the area of the laminating plant by almost 50% which will accommodate new bending furnaces, additional autoclaves, and assembly space, so that this plant which is now the largest producer of safety glass in the world will be still larger and more nearly self-contained.

Additional twin-grinding equipment has been installed to aid the productive capacity of another plant.

Another company is building a 34 million dollar precision-ground plate glass plant at Cumberland, Maryland.

Plans for the construction of a multi-million dollar window glass producing plant at Decatur, Illinois, have also been revealed. Initially, the Decatur factory will include one glass tank with the glass ribbons being drawn off through four drawing machines. It will utilize the Pennvernon process of window glass manufacture, a Pittsburgh Plate Development.

The Illinois site was chosen because it was strategically situated to service the large St. Louis and Chicago market areas and the sash and door fabricators along the Mississippi River and its tributaries. Ground will be broken early in 1956.

Construction work will commence soon on a multi-million dollar Glass Research Center in Harmar Township near Pittsburgh. The development and product control building, first of the two structures to be constructed, will have an area of 170,000 square feet. The building will have a high bay designed to accommodate pilot plant equipment and provide ventilation over high-temperature areas such as tanks and furnaces. The bay will cover an area 480 feet by 260 feet and will have movable partitions in the shop areas.

The basic research building will be a glass-clad structure of six floors and will have 70,000 square feet of floor space. This structure will contain chemical, physical, and analytical laboratories plus administrative offices and a library. It will feature movable partitions and will have a connecting passageway to the development building.

Jet Speed Planes Demand Utmost in Window Utility

Aircraft glass has to be skillfully put through bending furnaces; heat-treating; assembly of glass, plastic and metal edge sandwiches; lamination; and checked with precision instruments at every turn to meet the final rigid military specifications. While the average automobile laminated safety glass is about one-quarter-inch thick, many of the aircraft windows are two or more inches thick with many layers of glass laminated into a high quality optical instrument for seeing. In fact, aircraft glass embodies almost every process used so that it is a recapitulation of the most modern techniques used in several other products. Some units even employ the double-glazed insulation idea.

Where planes in the last war flew 300 to 400 miles per hour, now frequently the sky fighters slash through the air at two and three times that speed. Slight distortion in windows could mean a target missed. Much of the aircraft glass must provide maximum visibility in all kinds of weather; therefore, it has built-in electrical conducting glass with transparent coating which provides resistance heating to melt away ice and fog.

The greater speeds and higher altitudes mean that the aircraft glass must be structurally strong to an exceptional degree. Several laminations are used and certain of the glass layers are heat-treated to make them five or six times stronger, tougher, and more flexible than the conventional plate glass.

Progress has also been made on aircraft glazing for high-speed supersonic aircraft. Many of these lights involve several thicknesses of glass including electrical coatings for positive electric heating to dissipate ice and fog. Heat-treated glass for added strength, with metal edges laminated into the glass and curves to fit the plane contours, has also been developed.

Radiation Resisting Glass

Completely assembled radiation-shielding windows for nuclear research are now available. Consisting of castings of radiation-resisting glass up to 10 inches thick stacked together in a framework, the units are shipped ready to install in test cell walls.

Used to protect research personnel by reducing radiation intensity to a tolerable level, the windows permit visual observation of work carried out remotely in "hot" areas. The new package units, which are available as either wet or dry-type assemblies, eliminate construction and assembly work at the laboratory site. Wet-type assembly windows are shipped already charged with index oil.

Three special glasses with densities of 2.7, 3.3 and 6.2, are uesd in the "package" windows. These closely match the radiation absorbing properties of ordinary concrete, barite concrete, and iron or steel. Each of the glasses is sufficiently stabilized for all practical purposes to prevent the darkening effect of x-ray or gamma-ray exposure.

Spandrelite

A new building material, which promises to glamorize the major buildings of America, has been developed. Initial manufacture includes panel sizes up to 48 in. x 84 in. The heat-strengthening process, which fuses ceramic color to the plate glass base, gives the entire structure far greater shock resistance than ordinary plate glass of the same thickness.

In addition to custom colors, ranging from pastels to chartones, and textures from polished to tapestry, eight standard colors will be provided in a choice of polished plate glass or twill gestures in opaque finishes. Special designs, insignia, trade marks, plaid, spatter, and mottled patterns are also possible as well as metallic and iridescent effects.

Unlike surface coatings used on many building panels today, Spandrelite color is said to be a fused vitreous material that has the ageless beauty of glass. In building construction, the color side is mounted to the interior, thus providing the additional weather protection of a quarter-inch or more of glass. The product is non-porous, self-cleaning, non-absorbent stain and odor proof.

Spandrelite was designed primarily to meet the demands to provide colorful spandrels for glass-clad buildings such as colored plate glass does for store fronts. There have been many requests for a glass suitable for encasing skyscrapers. This may be the ideal product for that purpose.

A number of glass-clad buildings using Spandrelite have been completed and several more are now under construction.

Luminous Electric Windows

What will the windows in the homes of 1975 be like? Researchers are continuing their work on glass which "conducts" electricity, grows warm and radiates heat at the touch of a switch or glows with softly diffused light in a variety of colors. The glass was developed for use in aircraft during World War II and is now widely used as windshields in airplanes and the bridges of ships to ensure maximum visibility by preventing icing or misting. A minute film of transparent metallic oxide on the surface of the glass is the secret of this glass's ability to "conduct" electricity. This film is 15 to 20 millionths of an inch thick.

The film is as durable as the surface of the glass and does not create any cleaning problems. It can be cleaned just like any other window. The glass itself is semi-tempered during the application of the film and is therefore tougher than regular glass. When an electric cur-

rent flows through the metallic film, the glass grows warm and radiates heat. The intensity of the heat can be turned all the way up to 450 degrees without endangering the glass.

Such windows become a lighting fixture through "electroluminescence." This is achieved by another minute film of various phosphors. So far scientists have developed films which glow with blue, blue-green, green and yellow light and are working on a phosphor to produce red which, when found, will enable them to make windows glow with almost any desired color.

The glass will be heat-tempered, twin-ground plate glass, so distortionless that from indoors the grass and trees outside will seem to be a part of the room. When the sun goes down, a simple turn of a rheostatic switch will make the window wall become a glowing panel with a light as delicate as moonlight or brighter if desired.

On cold days, when the temperature slides below the thermostat setting, another switch will trip and the glass will grow warm, heating the room with radiant heat and preventing the windows from frosting over or collecting condensation.

Indoor Sky

Three lighting principles incorporated in the fundamental design of the several types of lightingware are those of prismatic, diffusing and louvering actions. To meet these varying requirements, Corning scientists developed glasses of different characteristics: water-white crystal for prismatic panels to give maximum light transmission and color control; opal glass for soft diffusion, photosensitive glass for louvering effect; borosilicate glass for resistance to incandescent lamp heat.

For installations requiring relatively high intensity free of glare, prismatic designed glassware is widely used.

Where light diffusion is desired, panels of opal glass give complete diffusion and excellent brightness control.

Louvering action, without unsightly egg-crate grids, is possible with photosensitive glass. Through a photographic process, whereby an image is produced in the glass itself, opal louvers are separated by crystal-clear cells. Vertical light passes unrestricted through the glass while high-angle glare is cut off by the louvers. The Fresnel-type prismatic lenses are produced in a wide variety of sizes, shapes and optical characteristics which give complete flexibility of design.

Each of these several forms of glass lightingware can be adapted to different lighting requirements. In some instances the lighting actually becomes part of the interior theme and luminaires take such shapes as wide bands, squares, or circles of light. Fluorescent troffer lighting is also popular because it can be recessed or surface mounted and can be arranged individually or in continuous rows.

III. Glass Fibers

Since the introduction of glass fibers in 1938, sales have climbed from $3,800,000 to $165,500,000 in 1954. In 1955 the sales volume was approximately $200,000,000. The sales goal for 1960 is conservatively estimated to be $250,000,000.

By that time, output of the whole industry may well be somewhere between one-third and one-half billion dollars, a rather remarkable growth for a business whose total sales were only $3.8 million as recently as 1939. Its unusual diversity provides its greatest protection against recession.

Insulation

One product recently introduced, is glass fiber foil-enclosed residential building insulation, offering a combination of advantages for more comfortable, healthful, economical year-round weather-conditioned homes. The glass fiber insulation blocks prevent the entry of outside heat in summer and escape of inside warmth in winter. The foil serves as an efficient vapor barrier and adds insulating benefits by reflecting radiant heat.

A new structural glass fiber ducting, with an outer reinforced foil facing, is used in low cost central air-conditioning systems to keep circulating air cool and to quiet operating noise.

Insect Screens

A prominent position in the competitive insect screening market has been established by vinyl-coated glass fiber screen, now in its second season of public distribution. Sold nationally through hardware stores and lumber yards, glass fiber screening combines resistance to rust, rot and corrosion; freedom from stretch or shrinkage; fire-safety; and ease of application to framing.

Acoustical Insulation

In the sound control field, architects and decorators are finding new opportunities to create distinctive ceiling effects through the available range of glass fiber acoustical products, in various textures, colors, and tile and board sizes. The combination of decorative qualities with their ability to cut down noise, fire safety and other functional advantages have opened new markets for glass fiber sound control products in public establishments and homes where ordinary acoustical materials would be unacceptable.

Decorative Fabrics

Beauty and practicality also are combined in glass fiber decorative fabrics, obtainable for both traditional and contemporary interiors in many weaves, solid colors and printed designs. In addition to a translucent quality under sunlight that no other fabrics have, these all glass curtains and draperies have many practical advantages, particularly for large picture window expanses. Glass fiber materials are easily cleaned or washed. Entirely wrinkle-free, they never need ironing. They are undamaged by sun rays or radiator heat and provide insulating benefits.

Reinforced Glass Fiber Plastics

In Akron, Ohio, massive Goodyear Tire & Rubber Co. presses are stamping out glass fibre boat hulls claimed to be lighter, faster and more durable than wooden boats at the same price.

Ford station wagons are rolling off assembly lines

with glass fiber trim replacing wood, at half the price of the previously used hard maple. Ford is also using a glass fiber plastic top for its Thunderbird sports car.

In the glass fiber industry, Goodyear's boat stamping is drawing much attention because the manufacturing process is closely akin to mass producing auto fenders and body panels. For many years, auto makers have eyed plastic as a possible light weight replacement for sheet metal bodies, but they have never solved processing difficulties. It is hoped that Goodyear's boat pressing experience may provide some of the answers to making plastic parts for cars.

Goodyear has five presses, ranging from 100 tons to 700 tons, and any one of them is capable of handling fenders or auto body panels. The largest press now is used to stamp out 16-foot boat hulls.

Bowman Boat Co., sole outlet for the glass boats, says its contract with Goodyear calls for "around 10,000 boats yearly." Goodyear makes only the plastic hull; Bowman fits the deck, gunwales, and other equipment.

The maker of the Chevrolet Corvett body, Molder Fiberglas Co., of Ashtabula, Ohio, is also pressing a 15-foot glass fibre boat. The company is making about 20 of these boats a day and is considering a new plant and another press in order to double production. The boats are sold to four boat makers who finish and sell them for $395 and up, about $50 to $75 less than a comparable plywood boat.

Experimental "Dream" Cars

General Motors, which first introduced the "Dream car" idea to the auto industry seventeen years ago, presented seven new experimental cars embodying advanced concepts in design and engineering at the 1955 Motorama.

G. M. stylists point out that all experimental cars are designed for function as well as for beauty and grace of line. Features which make them more eye-appealing also make them safer, easier to operate, and more comfortable.

The seven cars, plus an experimental truck, were designed by the G. M. styling staff and include many novel uses of glass in sheet and fiber forms.

Miscellaneous Uses

Fiberglas-reinforced plastics are making gains both in total sales volume and new product applications. Among these are a nationally prominent line of golf clubs whose glass-fiber reinforced shafts are said to impart a "live" action that increases accuracy and hitting power, a hammer with a reinforced plastic handle claimed to be stronger than steel, while retaining the resiliency and handleability of hickory; corrosion-resistant chlorinators used by both industry and municipalities; and swimming pools, made in sections for easy installation, that resist dampness and corrosion.

The tough lightweight materials are important in weather-resistant boat covering, truck bodies, appliance components, furniture, and many industrial products.

Filmglas

A new product developed by Owens-Corning Fiberglas Corporation called "Filmglas," is being evaluated. It consists of thin flat glass flakes that are made by blowing and then shattering a glass bubble. Now being produced in pilot quantities, the material is being studied for possible electrical, plastics reinforcement, packaging applications, and other uses.

New Fiberglas Plant

Owens-Corning Fiberglas Corporation has also announced plans to build a plant in New Jersey to be devoted chiefly to manufacture of fiberglas insulations, noise control products, and other building materials.

The new plant will be built on a 120-acre site, on the New Jersey Turnpike, seven miles southeast of Camden.

Plans to build the new plant reflect the development of new markets for Fiberglas products as well as expansion of many established markets. Both factors are linked with continuing product development.

IV. Glass Containers

Production

Production of glass containers in 1955 was approximately 130 million gross or 18.7 billion units. This figure represents a record production and exceeds the former high figure in 1953 (128.9 million gross).

A comparison of glass container production for the first eight months of 1955 and 1954 is shown in Table I. Increased production of beverage bottles is quite evident in both returnable and non-returnable classes. One-way beverage bottles have continued to show sustained growth over the past several years. Increased production of beverage bottles has been significant in spite of strong competition from metals and other sources.

Table I
Glass Container Production, First 8 Month 1955*
(000 Omitted)

	1955	1954	% Change
All Types Total.....	91,942	88,218	+ 4.2
Narrow Neck			
General Use	33,171	31,904	+ 4.0
Beverage—returnable	6,959	6,001	+16.0
Beverage—non-returnable .	1,000	908	+10.1
Beer—returnable	2,183	2,159	+ 1.1
Beer—non-returnable	5,866	5,905	— .7
Liquor	6,005	5,836	+ 2.9
Wine	2,856	2,900	— 1.5
Wide Mouth			
General Use	30,734	29,385	+ 4.6
Dairy	1,810	1,840	— 1.6
Packers' Tumblers	1,358	1,380	— 1.6

General Use Includes: Food Containers; Medicinal and Health; Household and Industrial; Toiletries and Cosmetics; Domestic Fruit and Jelly (Wide Mouth).

*Glass Container Manufacturers Institute, Inc.

Amber bottles are being used in the dairy industry in several localized areas, such as Louisville, Dayton, and Detroit. It has not been universally accepted and therefore has shown only limited production.

All major types of glass containers showed gains in shipments in 1955 over the 1954 level. The food industry took 7 per cent more, although food consumption rose only about 1 per cent. Use of glass for packaging baby food has shown a particularly strong growth. Shipments of glass containers to the liquor and wine industry were 10 per cent and soft drink bottles 7 per cent of the total glass containers market in 1955, while glass containers

for beer were 7 per cent of the industry shipments.

Glass container shipments have increased 171 per cent since 1939, a period in which the population has risen 26 per cent and consumer purchasing power 98 per cent. It therefore appears that the public is accepting a steadily increasing amount of glass-packaged products.

Improved Techniques for the Container Industry

A new device has been developed which automatically inspects baby food jars for vertical and radial checks in the finishes. This equipment also has application to any glassware similar to baby food jars such as wide mouth food jars or packers tumblers. The equipment is designed to operate at about 70 jars per minute, maximum rate. The apparatus employs a light beam and photo cell combination. When a check appears in the path of the light, reflection from the check enters the photo cell and a mechanism is actuated to discard the jar. The sensitivity is adjusted so that stray light or false reflections can be discounted according to demands of the inspection. From the automatic inspection they may pass visual inspection stations, and finally be automatically cased.

The demand for greater production and the need for forming machines of greater capacity has been growing. The increase in conversion to 6-Section I.S. machines has been evident as well as greater application of double-gobbing. More effective use of double-gobbing has been brought about by the use of angular shearing which permits greater freedom of plant layout. It used to be necessary to have the I.S. machine placed at right angles to the feeder axis, but with the use of angular shears greater flexibility of the machine installation with respect to the feeder is permitted. In order to take care of this increased production larger lehrs, up to 6 feet in width, are becoming common along with the gang stackers to handle the higher productivity. The gang stacker which lifts a whole row of bottles from a collecting belt and deposits it, without glass-to-glass contact in the lehr, is solving most lehr-loading problems.

There appears to be a definite trend toward more colored glasses, particularly emerald green and light green. In view of the continued shortage and high cost of selenium it may be that more and more colored glass may be produced in the future. It is also possible that some new color, such as a light amber, a yellow, or a new green that possesses desirable transparency, might be desirable and acceptable for packaging many types of food products that are not now packed in glass.

Glass Aerosols for Antiseptics and Disinfectants

The year 1955 marks the beginning of the second decade for the aerosol industry, a decade which when measured against the past ten years promises to hold considerable possibilities. Since its introduction to the general public in 1945, a steady progression of improvements and new developments which have made it possible to consider the marketing of many types of products utilizing the various "aerosol" principles.

Alcohol-based aerosol products in glass have been particularly encouraging. Since this system produces a fine atomization of product at pressures of the low order of 15 psig. and even lower, the introduction of the ultra-low pressure system has made it safe and practical to package alcohol-based aerosol products in glass and other frangible containers.

With careful control of the proportions of alcohol, water and propellent, it is possible to produce a spray of almost any desired degree of finess with the use of conventional spray-heads.

Data have been reported on low pressure solvent-propellent systems suitable for basic formulations of aerosol colognes to be packaged in glass containers. These data include pressure, spray characteristics, solubility and to a limited extent, flammability. The solvent-propellent systems studied include varying alcohol-water mixtures with the two propellent solutions, Freon-12 dichlorodifluoromethane—Freon-11 trichloromonofluoromethane and also Freon-12—Freon-114 dichlorotetrafluoroethane.

V. New Developments

Glass Molds for Precision Casting

Development of a fast economical method for the precision casting of metals through use of glass molds has been announced.

The process, designed especially for work with high temperature alloys, assures an excellent surface finish and the close dimensional control required in precision casting. Because molds can be used at extremely high temperatures, design of fine detail and close regulation of metallurgical structure is possible.

In the test production of items such as jet engine buckets and vanes, 90 per cent of the finished castings have met precision standards on surface finish. The process eliminates the precoat step in investment casting and the undesirable cracking and spalling which necessitates rejecting a high percentage of the castings.

Easy to use, the mold powder is essentially a 96 per cent pure silica glass which is mixed with water to produce a casting slip. The slip is poured into the porous plaster mold and allowed to stand from 5 to 10 minutes until enough water has been absorbed to build up a shell of glass solids to the desired thickness. Excess liquid slip is drained off for re-use, and the glass shell is dried for 15 minutes at 140° F. After removal from the plaster form, the shell is oven-dried at 200° F., and then fired for half an hour between 1740° and 1920° F., depending on the strength desired. The cast mold is then ready for immediate casting or for storage.

The process is suitable for any conventional casting method. This, plus the low tool-up costs and extremely high selection of good castings, means a more profitable operation for the foundries which adopt it.

Castings produced by the process have blemish-free surfaces of better than 40 micro-inch finish, requiring little or no further conditioning. The mold material has high chemical stability and does not react with the metal or its oxides to cause surface imperfections. Accurate control of grain size is thus possible even at metal pouring temperatures as high as 3200° F.

Heat Exchanger

Production of a borosilicate-glass shell and tube heat exchanger which is virtually impervious to corrosion has

been announced. The completely new type unit was developed especially for processing industries where chemical resistance and product purity are primary considerations.

Field-tested for a year, the 50-square-foot capacity heat exchanger has proved to be highly efficient, versatile and economical to install, operate and maintain. Extreme operational flexibility is assured because working parts resist attack by all acids except hydrofluoric.

The light walled tubes have a conductivity coefficient, h, of 260 BTU/hr/ft^2/Deg F and overall values, U, have been measured up to 195 BTU/hr/ft^2/Deg F in water-to-water tests. The straight line flow and smoothness of the glass assures extremely low friction loss. Operating temperatures up to 375° F. are possible on the shell side and 200° F. on the tube side, while operating pressures can be as high as 20 psi.

The new heat exchanger can be used as a condenser, a cooler or a heat interchanger. Product can be introduced in either the tube side, the jacket side, or both, and the unit can be changed readily from one process to another.

Dosimeter

The broad field of atomic energy is presently receiving a great deal of attention. This interest is directed toward the development of special glasses for specific atomic energy applications and toward the use of nuclear radiation as a research tool in the continuing project of research in glass.

A silver-activated phosphate glass developed by the U. S. Navy is being used in the manufacture of a locket-type personnel dosimeter. This inexpensive device records the radiation to which its wearer has been subjected. To date, nearly two million of these have been supplied to the U. S. Navy, and the U. S. Air Force. The Federal Civil Defense Administration has approved them for civilian defense use and a limited number have been sold to local and state organizations. In its official publication, the federal agency suggested that each member of a civil defense emergency team entering a radiation-contaminated area might be provided with a glass dosimeter.

Ultrasonic Delay Lines

Continental defense will be aided by ultrasonic delay lines recently built. The largest of their type ever made, they have been delivered to the Lincoln Laboratories at the Massachusetts Institute of Technology for use in experimental radar equipment being developed for North American defense installations.

Ultrasonic delay lines are used to reduce the speed of electrical signals almost 100,000 times. An electrical signal takes as long to pass through one of the thin 20-inch diameter Corning units as it would to travel by wire from New York to Detroit.

The disks are made of fused silica glass, produced under a patented process. Previous to this use of fused silica, delay lines were made of either fused quartz or mercury.

However, mercury is rendered inoperative by low temperatures or shock, and, until recently, fused quartz had to be imported from Germany. Extreme cold does not affect the domestically-produced fused silica, and it is expected that the new extra-large delay lines will make an important contribution to continental defense.

Glass and Atomic Energy

The use of atomic energy has created sufficient interest for the creation of a special department within certain companies to study its importance in relation to various glass products.

One of the first reactor projects planned is an investigation to determine more completely the effects of various types of nuclear radiation on a wide range of glasses and refractories.

The unusual properties required of materials used in atomic energy application have some similarity to those found in glasses for such fields as electronics and chemical processing. Glasses used in these fields are being studied for possible nuclear energy applications. A new type of fused silica, only recently developed for electronic purposes, exhibits an unusual resistance to radiation darkening. Further work on this material is being carried out in cooperation with government and private laboratories.

The following leading companies will cooperate in building the world's first nuclear research reactor to be used in industrial and humanitarian fields and to be owned and operated by private industry: Corning Glass Works; American Tobacco Company; AMF Atomics, Inc.; Continental Can Company; International Nickel Company; Charles Pfizer and Company; Socony Mobil Oil Company, Inc.; and the United States Rubber Company. Other companies are expected to announce their participation shortly.

VI. Glass Blocks

The production of glass blocks for 1955 was approximately 15 per cent greater than in 1954. Recent developments in this field have been toward greater adaptation of industrial glazing and uses where outside glare has been a serious problem.

The standard line of functional glass blocks is a careful balance between maximum usable illumination and low panel brightness—under average exterior daylighting conditions. This method of fenestration is very simple and effective and probably no other method of glazing will give such high illumination along with such a low brightness level. For most purposes of outside lighting, where average conditions exist, the functional glass block is ideally suited.

For use where outside glare may be quite severe a modified glass block has been employed. Such a problem may exist with southern exposures where the sun bounces off the ground with a ferocity that defies ordinary effort to keep-it under control. The problem may exist in the far north where the snow lies on the ground for long periods, or where rooms overlook a blinding expanse of white concrete parking area.

The painful problem of excessive glare has been controlled by the use of a block containing a pale green fibrous glass diffusing screen. The screen divides the block into two insulating cavaties, softens the light and

reduces the intensity. At the same time internal prisms on the inner surface of the blocks throw the light upward onto the ceiling in light-directing patterns above eye level, or they diffuse the light in all directions. An opal-glass edge that is sealed between the two block halves prevents unfiltered light from reaching the panel interior through the edge of the block.

These blocks are available in three different patterns: (1) Light-directing prism for use above eye level, (2) light diffusion prism only, and (3) light-direction prisms for use in top-lighting systems. The controlled-lighting blocks have about 35% less brightness and 25% less instantaneous heat gain than standard glass block. The double cavity reduces heating and cooling costs. Since a partial vacuum exists in each cavity, the block acts as an insulator. The insulating efficiency is equal to that of an 8-inch masonry wall or about twice the insulating efficiency of ordinary windows. This type of block is now available in both 8-inch and 12-inch sizes.

Five-story glass block walls at Philadelphia Electric's new Cromby Station. Over 11,000 glass blocks were used in the north and south walls of the huge generator room. *Courtesy Pittsburgh Corning Corporation.*

VII. Electronics

Radio

Since the advent of commercial broadcasting in 1920, over 230 million radio receivers have been manufactured. Approximately 125 million radios are estimated to be in use at the present time. Of these, 30 million are in automobiles. More than 95 percent of all homes in the United States have one or more radios. From only a few broadcasting stations in 1922, the number has grown until now there are approximately 2700 (AM) and 535 (FM) stations. Radio station revenues have grown from approximately $79 million in 1935 to over $450 million in 1954. Approximately 70,000 persons are employed in radio and television broadcasting. Such growth has been made possible through the use and contributions of glass technology.

In the year 1955 there were about 13 million radios produced.

Cumulative sales of receiving tubes in the first eight months were reported by Radio-Electronics-Television Manufacturers Association as 300,080,000 valued at $222,948,000 compared with 225,085,000 tubes worth $162,807,000 sold in the comparable 1954 period.

The following table shows receiving and picture tube sales by months during the first eight months of 1955:

Table II

Sales of Receiving and Picture Tubes for First Eight Months 1955

	Picture Tubes		Receiving Tubes	
	Units	$ Value	Units	$ Value
January	866,956	17,661,018	37,951,000	26,879,000
February ...	859,529	17,119,568	38,526,000	28,108,000
March (5 wk)	913,003	17,625,881	40,859,000	29,743,000
April	788,317	14,620,075	35,426,000	26,780,000
May	779,329	14,572,518	32,919,000	25,916,000
June (5 wk).	706,890	13,244,499	40,821,000	31,256,000
July	515,793	9,498,169	28,340,000	21,167,000
August	1,048,534	19,812,567	45,238,000	33,099,000
	6,478,351	124,204,295	300,080,000	222,948,000

Outstanding developments in the past year in the radio field have been the commercial introduction of general purpose transistors to replace electron tubes in some instances. Two types of these small solids, less bulky than tubes, have been made available for military and commercial use. Innovation in chassis construction have also been made from the use of printed wiring boards. Nearly 1 million radios have replaced complicated wiring systems with printed circuits.

Television

The growth of television has been confined largely to the period following World War II although a few experimental stations were operating as early as 1928.

Since 1946, nearly 40 million TV receivers have been manufactured. Over 35 million of these sets are in use today. The number of stations broadcasting has grown until now over 530 TV stations are on the air. Over 100 of these are in the new ultra high frequency (UHF) portion of the spectrum.

Manufacturers' sales of television picture tubes have grown apace with the production of receivers. In fact, due to the growing market for replacement tubes, sales have surpassed the production sets. In 1954 nearly 10 million picture tubes were sold by the manufacturers and approximately 8 million tubes were manufactured. In 1955 about 9.75 million cathode ray tubes were produced and it has been estimated that approximately 6 million black-and-white television sets were sold.

Not only has television's growth been reflected in the number of tubes sold, but also in the dimension of the tubes as technological developments have made possible larger picture sizes. In 1949, for example, over 80 per cent of the picture tubes sold were under 14 inches. Of

(*Continued on page* 46)

Sixteenth Conference on Glass Problems at Urbana, Illinois

"NEITHER wind nor rain, nor snow, nor gloom of night shall stay these couriers from the swift completion of their appointed rounds". This quote may well describe our postal service but it also is applicable to the over 200 registrants who were sufficiently interested in the practical side of glass technology to brave the cold, the snow and the fog in order to attend the Sixteenth Conference on Glass Problems held on December 1 and 2 in the Illini Union Building, on the University of Illinois Campus, Urbana, Illinois. This splendid attendance once again attests to the popularity of these conferences and also to the interest in the well balanced program provided by Dr. Fay V. Tooley.

On Thursday morning, after a very warm welcoming address by Dr. Ross J. Martin, associate director of the Engineering Experiment Station, University of Illinois College of Engineering, the chairman of the first session, Robert J. Cunningham, of Owens-Corning Fiberglas Corporation, Newark, Ohio, introduced the subject category "Flow, Convection and Temperature as Factors in Glass Preparation". The afternoon session was presided over by Hayden M. Setchel, Owens-Illinois Glass Company, Streator, Illinois. A total of seven papers dealt with the various aspects of this subject and all were earnestly and ably presented by their respective authors. Needless to say, after listening to each of the seven papers, plus the interesting from-the-floor discussions this reviewer is just a little on the confused side but a ray of light is dawning. It would seem that there are as many ways of running a glass furnace, in order to obtain the desired end result, as there are people connected with them. We know some things for sure, we think we know some things and we are guessing at others. Practical, try and try again procedures are slowly giving way to the analytical approach and it is just this type of meeting that will hasten our arrival at Utopia.

Conditioning of Glass for Plate Glass Manufacture. *By J. A. Slaughter, Pittsburgh Plate Glass Company, Crystal City, Missouri.*

Mr. Slaughter, being a member of Crystal City's Tank Furnace Department, emphasized the practical side of the plate glass melting and conditioning problem and first discussed the flow of batch after the filling operation, the effect of reversing the gas and air flow, the fluctuation in the regenerator temperatures between reversals and its effect on the furnace temperature and the influence of flame lengths and flame coverage on the temperature distribution over the batch.

A short discussion was devoted to the fining phase of glass melting and it was pointed out that in order to obtain the best possible product, the highest temperatures that are consistent with the refractoriness and durability of the furnace materials must be attained.

In the case of the conditioning phase of plate glass manufacture, the different methods in use for cooling the glass to the desired rolling temperatures and viscosities were discussed and included the use of the curtain or shadow wall, floaters, water-cooled skim bars and negative pressure or partial vacuum near the rolling end.

Surface flow tests were also discussed by Mr. Slaughter and it was shown that the most worth while information derived from such surface flow tests is that the speed of flow between any two points in the furnace was roughly proportional to the temperature differential between those two points. It was further shown that any connection between quality control and the data obtained as a result of flow tests was, in general, not conclusive enough to be of definite value to the furnace operator.

Problems of Conditioning Glass for Window Glass Manufacture. *By Henry E. Walker, Harding Glass Company, Fort Smith, Arkansas.*

To Mr. Walker, whose conditioning problems have been concerned primarily with the Fourcault process, there are two major problems connected with "conditioning window glass for manufacture"; one is the problem of homogeneity and the other much related problem of temperature breakdown and heat control.

The one enemy of glass conditioning that is always present is best described by the one word "variables". Conversely, the one enemy of "variables" can also be described by the one word "uniformity". Unfortunately, one can set a uniform conditioning pattern and achieve the highest degree of efficiency possible but the threat of "variables" is always present.

"What are some of the variables?" An answer, in part, is to say, "any variation from a standardized, set, or uniform condition being used to produce the desired conditioning of glass". It is important to remember that the set of uniform conditions will not necessarily be exactly the same on any two furnaces even though similar results may be achieved on all the furnaces so ideally set.

By the use of a schematic drawing some of the hard to control variables were discussed in the form of questions. For example, does the hot spot from each individual pair of port burners remain in the same place relative to the furnace on each reversal, or do they vary from the centerline somewhat? Does the hot spot in the furnace tend to remain in one place unless it is purposely moved? Is there more than one hot spot in a furnace? Does its location affect glass conditioning? Does the type of fire on a furnace have an effect, i.e., oxidizing vs. reducing or oxidizing on third port and reducing on first port, or vice versa?

How can one bring down the high temperature involved in the melting process, to the low temperature required for drawing and at the same time have the homogeneous, well-conditioned glass that is desired?

There are many devices used to accomplish this temperature breakdown, including the sprung "shadow wall", floaters, skimmers, hairpin coolers, straight pipe coolers, cold air, venting, insulating and electric heat. How do these various devices function and how do they affect the glass condition? Homogeneity? Glass flow, etcetera. All of these things are either variables or unknowns and each of them has an influence on the problem of glass conditioning.

To illustrate, Mr. Walker called on his practical experience to answer one of his questions, namely, "what was the original purpose for using floaters? Are floaters used for the same purpose today as they were originally? What happens in a tank where floaters are used? What effect do they have on glass condition?" Mr. Walker feels that they were used primarily to arrest unmelted batch and other floating foreign matter so it could be skimmed off before it reached the working area and also to separate the melting area from the working area. Under present conditions of modern batching, there is nothing to skim and floaters, therefore, have little value as skim baffles. However, there is still the matter of the physical separation of the melting and refining sections and setting a 16 inch floater into a 48 inch furnace certainly separates it; the body of glass is cut in two to the extent of 32 per cent. After a week or two the bottom and sides begin to erode and at the end of five months the orifice under the floater is so enlarged that only about 22 per cent of the body of glass is restricted. Replacing the floaters temporarily restores the 32 per cent restriction. It appears that convection currents would be affected by the floaters in place and that they would change as the floater depth diminished and, thereby, give way to constant change or another variable. How can this be controlled?

Now take the case of a furnace which is operating satisfactory and producing better than average glass and, based on past experience, the time elapses and you set floaters. After a few days cordy and stoney glass appear in one or two machines only. Where's the trouble? The floaters were identical with those replaced and all furnace conditions were the same. After a few weeks the trouble is still localized so you take first one and then both machines out of service and the remaining machines stay unaffected. This is repeated several times and it looks like a local condition. After six or eight weeks the condtion has gradually cleared up and the operation is fair until you set floaters again. After fighting it for a while with no results, you take the floaters out and do not reset. The glass clears up and operation continues satisfactorily. If the floaters caused the trouble why didn't they affect all machines? Why didn't the defects spread when the affected machines stopped drawing? It is problems such as these that prompt the questions!

Flow and Temperature Conditioning of Glass for Container Glass Manufacture. *By Roy S. Arrandale, Thatcher Glass Manufacturing Company, Inc., Elmira, New York.*

In the overall process, glass is squeezed down from a large mass within the furnace to a gob size suitable for forming—hoping to smooth out in the transition the upset of temperature gradients associated with the changing cross-section of the stream. Some 60 per cent of the cooling comes from the furnace throat, the remainder from the refiner and forehearth.

The objective in the cross section of the forehearth channel is to heat the edges and cool the center of the stream—to turn the flow of glass from what would otherwise be parabolic to even flow rate across the channel. Lengthwise, the objective is to cool the back section as rapidly as possible, using high fire on the front end to flatten the falling temperature curve. The problem of cold glass on the bottom was discussed.

The size and depth of refiners was also discussed. It was pointed out that both the refiner and the forehearth merely take glass as it is and put the finishing touches to it—the glass itself being no better than when it arrived.

Mr. Arrandale believes that the real conditioning of the glass is done in the batch house and in the space covered by the batch blanket, which he calls the "effective mixing capacity" of the tank.

Accepted principles are that the batch melts and then, by a complex action of thermal convection currents, which are claimed to be under control because the hot spot is in the right place, frees itself of seed and inhomogeneities. While conceding that convection currents do exist, and are important in an idle furnace or one in a state of low pull, Mr. Arrandale feels that they are negligible in effect in a furnace running at high rate of pull, and exert mainly a contaminating influence on the main movement of glass.

The lack of mobility necessary to support wide scale thermal convection currents was shown for amber glass in depth as against flint glass. The higher the tonnage the more stiff the bottom glass becomes. Yet, on the same furnace with equal operating conditions and

homogeneity, the maximum possible tonnage is at least equal for the two and actually in the amber's favor. The conclusion is that the mechanism of mixing is about the same for both.

Data taken from four successive running conversions of a large furnace at high pull from flint to amber was analyzed. The amber was the denser of the two. By means of flame photometer measurements for MnO the progress of the transition could be traced. It was found that the tank has converted essentially 100 per cent from flint to amber when 170 per cent of the dimensional contents of the tank are withdrawn.

By comparison with the limits of ideal mixing and ideal displacement it is found that nearly theoretical ideal mixing has occurred from 100 per cent down to 20-40 per cent of the flint glass still retained by the tank. From there on, the mechanism departs from a theoretical mixing based on the total volume of the tank.

By integration of the curves of log fraction still retained vs. cumulative tons—and correlating this with density differences—it was found that as the density difference between the glass of the batch being fed and the glass in the tank approaches zero, the slope of the curves approaches a common minimum from which Arrandale computes the "effective mixing capacity" as the equivalent of 42 per cent of the melter volume. This figure corresponds exactly with the volume of glass covered by the batch blanket.

With this reasoning a new theory was advanced that the normal glass at high pull, and without electric boosting and without artificial bubbling, is mixed only in the "effective mixing zone" and is virtually finished in homogeneity within the effective zone which measures from the doghouse to the end of the batch blanket.

It is expected that degree of homogeneity depends essentially upon three things: (1) The degree of homogeneity of the batch itself. (2) The level of temperature maintained in the zone of the batch blanket. (3) The amount of potential gas in the batch.

From there a revised theory of glass flow through the tank was discussed, which, it is realized, is not exact—wherein the glass following the lines of least resistance is essentially displaced in accordance with its "relative mobility" on through the throat in streamline fashion. There is no large amount of cross-movement in this picture and the characteristics of the left-hand side of the furnace, for example, are noticeably retained into the forehearths of the same side. The center of the surface moves the fastest and usually picks up a state of overpull first. Effects of composition density changes were discussed.

Several practical observations bearing on this theory were also discussed.

Comparative Tracer Tests on Container and Window Glass Tanks. *By Fred Bishop, Kimble Glass Division, Owens-Illinois Glass Company, Toledo, Ohio.*

Previous papers by Bishop on glass flow dealt with tracer tests on window glass tanks. Recently he made the same type of tests on container type tanks. The similarities and differences in these two types of furnaces are shown by a comparison of the results and form the basis of the present paper.

Briefly, the test technique is as follows: Cerium hydrate in a known amount is mixed with sufficient batch and cullet to fill for a known period. This mixture is put through the regular feeding method. Samples for testing may be taken in two different manners; those dipped from the tank at various locations were watched for the characteristic blue fluorescence of cerium by an ordinary black light in order to trace the flow of glass through the main tank. Samples of glass, being fabricated, were taken at regular intervals from each machine. These samples showed not only the arrival and diminution of the cerium but could be measured to show the actual amount of cerium present. This measurement is made by the means of spectrophotometer.

It was shown that the same general types of flow pattern, called for lack of a better name, "displacement" and "surface" flow, are common to both large window glass tanks and smaller container type tanks. The chief difference in the tanks lies in the slope of the integrated curves which show the relative slowness of throughput on the window glass tanks.

Additional detailed curves were given for container tanks which showed that for one such tank longitudinal flow is dominant with very little transverse mixing; from which was concluded that the usual spiral or helical flow as pictured by Gehlhoff cannot be taking place in this tank. In another curve it was shown that in addition to the primary peak (which shows the first arrival of the changed glass at the machines) a secondary peak is also found. This secondary peak was believed to be due to a portion of some of the changed glass bouncing back off the nose end walls, flowing back into the melting end and then flowing back into the forehearth with the main stream of original unchanged glass.

A New Look at Flow in Glass Tanks. *By Robert W. Hopkins, The Calumite Company, Hamilton, Ohio.*

Flow in the normal side port furnace is assumed to be taking place in the form of two wheels eminating from a hot point of a furnace, one progressing toward the charging end on the surface and back toward the hot spot under the surface; the other proceeding toward the bridge on the surface and back toward the hot spot below the surface. In order to obtain this pattern the furnace is operated in accordance with the dictates of the literature, i.e., the development of a hot spot at about number three port on a four port furnace with temperatures being reduced, both toward the charging end and the bridgewall. These are called normal convection current patterns and although various sidewinding eddy convection currents are known to exist, these are generally deemed of secondary importance.

On most side port furnaces operating today the above flow does not take place; instead, convection movement is overcome by other forces which are herein called "mechanical". These forces have increased in influence because of greater pulls on any given unit. There are two principal mechanical forces, (1) the "push" created by the batch being charged into the furnace and (2) that force caused by the equalization glass pressure between melter and refiner. The latter force is of such influence as to cause the main flow of glass to short circuit in a path from doghouse to throat. In so doing, many furnaces are directing glass to the refiner which has passed through low temperature zone under the glass surface

before it is thoroughly melted, hence it is likely not to be of best quality. Proof of the existence of this condition is shown by the formation of dormant areas of glass on the melter surface at bridgewall. Various other statements were made by Mr. Hopkins in order to substantiate this theory and direct issue is taken with the literature, mainly to the effect that temperature gradients should be changed to more nearly agree with those used in end port operation which is usually an increasing temperature gradient from the back wall to the bridge wall.

The speaker dealt mostly with amber container glass made on a side port furnace of conventional straight throat and bridgewall construction. However, the ideas expressed appear to be applicable to all colors of glass made on furnaces having this construction.

The statements made by Hopkins are not theoretical but are the result of observation on a number of operating units, as well as the actual placing into practice the flow pattern described. A number of illustrations were used in the explanation of flow and in different ideas designed to counteract undesirable mechanical forces.

Electrodes as Tools in Convection Current Control. *By Larry Penberthy and Lee Miller, Penberthy Electromelt Company, Inc., Seattle, Washington.*

There are several different ways of modifying convection currents in glass tanks, of which the use of electrodes is one. When such are used as a means of convection current control there are five main factors to be considered: (1) material of the electrode (contact resistance to glass), (2) size and current density, (3) total power load, (4) location and (5) orientation.

Material of the electrode influences heat release, according to the contact resistance, and this is a function of the wettability of the material by the molten glass. Oxidizable metals and the oxides such as molybdenum and iron are easily wetted and hence have low contact resistance. The contact resistance of platinum is higher. Carbon and graphite have still higher contact resistance as they are extremely difficult to wet.

Next to consider is the size of the electrode, meaning size in relation to the size of the tank together with the current density on the electrode surface. In a furnace equipped with iron electrodes in the form of large blocks and extending the length of the furnace, the convection currents will be upward in a full-length sheet, parallel to the side wall and downward along the centerline of the tank where the glass is cooled by the batch. When small electrodes are used there will be local-turbulence type of convection current columns going upward from the electrodes. As the size of the electrode is changed, the current density is changed and this has an effect on the convection currents. Going from a large area electrode to a smaller area electrode gives a quite different heat distribution in the circuit. The release in the region of the electrode is proportionately higher than it was before and by proper choice of current density and total power, the electrode can be used to create or diminish the existing currents.

Total power is a factor in the modifying of convection currents in relation to the size of the tank. For instance, 100 KW in a medium bottle tank is sufficient to do a very fine job of convection current control.

It is obvious that the location of the electrodes in the tank is important. Whenever heat is released, there will be a rising thermal convection current. Location of the electrodes with respect to one another is also important, since electrodes close together will operate to confine the heat release in the glass bulk to a small region, even to the point of setting up excessive convection currents.

The position in respect to the glass surface is also important, for the lower the level, the more is the stirring action. This can be bad, good, or depending upon the application.

Orientation is the last factor. A rod-type electrode extending horizontally into a tank has a more moderate effect on convection currents than a vertical one through the bottom. The vertical electrode tends to superheat a smaller volume of glass and bring it vigorously to the surface. This effect can be modified by various methods of installation.

The Effect of Thermal Current on Refractories. *By Ed Humphrey, Corhart Refractories Company, Louisville, Kentucky.*

The subject of convection in currents (currents of thermal origin) is highly controversial; one school of thought believing that such currents are of great benefit and necessary to good quality glass, while another school of thought believes that the supression of such currents gives better quality glass and longer refractory life.

Mr. Humphrey holds to the latter school of thought and suggests as one method of controlling these currents the insulation of the sidewalls and bottoms of the furnace. Observation of the performance of several furnaces so insulated revealed less refractory wear than normally experienced in previous fires and before insulation. Glass quality was excellent in all cases. The flow of the convection currents had been slowed by the insulation and this was, in his opinion, the contributing factor to the outstanding performance of these furnaces.

In view of the importance of these currents, it is unfortunate that more work has not been done in the glass industry and related industries on how to control them. Most operators control these currents to some extent by governing the location of the hot spot in the furnace and, while inadequate, it seems at present to be the best and most practical way. So many variables can affect the currents that the average operator is satisfied to leave well enough alone, as long as good glass is being produced. Present trends, however, indicate that quality demands will become more stringent and furnace loads are still increasing, both of which lead to the fact that one will become compelled to know more about convection currents and their control.

In order to show the many complications in the problem, Mr. Humphrey quoted several case histories; in one, a furnace which had been operating very well started giving bad glass. All known remedies were tried to no avail. The source of the trouble was finally traced to the basement windows near the furnace. When these were open the trouble occurred, when they were closed, the trouble cleared. In a second case, a bottle tank had a terrific cord and there seemed to be no solution to the problem. Finally, the operator turned off one burner in the fourth port and the trouble cleared. In both cases

these seemingly unimportant actions had some sort of an influence on the flow pattern in the furnace.

It is possible that more research on the behavior of these currents might indicate a radical departure from present day designs. Along this line one author has suggested a sloping bottom in the melting chamber, the slope to be from the doghouse to the throat. Others have shallowed their furnaces to reduce the action of these currents. Still others point to the excellent quality and high production from deep flat glass tanks and are convinced that this is the way to better glass. More attention to the nose end of the furnace is also in order. Convection currents are very active here and have a direct bearing on glass quality and refractory life. Already some operators are reducing the area of the working end and apparently with good results. Hartford unit melters have virtually no refining end. Borosilicate producers long ago found quality improved by minimizing the refining area.

Electric boosting offers excellent possibilities in the control of these currents. This is because heat can be supplied selectively, such as near the bottom of the tank, and the temperature gradient can be controlled. A recent innovation along this line is an application using electrodes in the throat sump only.

Another method that might be used to good advantage in producing good quality glass are air bubbles and a few companies are experimenting along these lines.

It was emphasized that regardless of what changes may come in furnace designs or operating practices, so long as we deal with the high temperatures required to melt glasses of various compositions, we must recognize the important role these currents of thermal origin play in glass quality and refractory life. A better understanding of convection in currents and their control is a future must.

Theory and Practice Concerning the Use of Minor Constituents in Glass. *By R. M. Wiker, Corning Glass Works, Corning, New York.*

Dr. Wiker gave an excellent summary of some of the more common uses of the various minor constituents that are used in glass in the amount of 1 per cent or less.

When used for fining, arsenic and antimony trioxides are oxidized to pentoxides when nitrates are present and at high temperatures the pentoxides revert back to trioxides, thus releasing oxygen during the later stages of the melt. The breakdown temperature is higher for arsenic than for antimony. The use of both materials together, therefore, prolongs the oxygen liberation time. Chlorides are used to fine borosilicate glasses in those cases where residual arsenic is undesirable. In lime glasses, sulfate fining is common and saltcake, barytes and gypsum can be used for this purpose. Blister problems can result in borosilicates following sulfate fined lime glasses. Some color materials, fluorine (usually as fluorspar), and boric oxide can aid fining.

Lithia and fluorine decrease sand solution time and thus increase the melting rate.

Boric oxide and alumina increase the chemical durability of the glass.

Solarization (color changes on exposure to sunlight) can be reduced by the presence of minor amounts of titania, antimony, or lead in the glass. However, glasses for germicidal and ozone lamps cannot be thus protected because these oxides absorb the short ultraviolet wavelengths and it is these wavelengths that the glass has to transmit.

The more common colors were discussed and it was emphasized that it is important to have constant melting conditions for red and yellow colored glasses. Black glasses which transmit ultraviolet or infra-red wavelengths were also described.

Various combinations of selenium, manganese, nickel and cobalt are used to complement the iron color in the case of glass decolorization. It was pointed out that the lower the iron content of the glass and the more oxidizing in the batch and furnace atmosphere, the more feasible decolorization becomes.

Along this line of decolorization, it was mentioned by several that due to developments in other fields the next few years may show an easing off of the present selenium tightness. This depends upon how fast a substitute material can be found for the present use of selenium in the electronic field.

New Factors Influence Plant Design in Glass Container Industry. *By Morton S. Cressy, Hartford Empire Company, Division of Emhart Manufacturing Company, Hartford, Connecticut.*

Since 1952 there have been a number of important developments in the Glass Container Industry which affect plant design and make it necessary to revise some predictions regarding trends in the industry. These developments may be summarized by one phrase—a new production line.

The new production line consists of an improved furnace, a better gob feeder, the 6-section I. S. machine, the higher capacity gang stacker, a new six-foot wide annealing lehr, automatic testing and automatic inspection.

Furnace design has progressed in two directions—one being toward larger more efficient regenerative furnaces and the other toward small efficient direct fired furnaces.

The small direct fired furnaces, usually referred to as unit melters, are capable of producing up to 40 tons of glass per day and, because of the simple design and special method of operation, are characterized by low cost of maintenance and of repair and a surprisingly low fuel requirement.

The modern regenerative furnace is capable of a scheduled three year campaign and usually can be made to operate efficiently for longer periods if necessary.

Comparison between a 600-square-foot regenerative furnace and an (8x36) unit melter shows the total operating cost, assuming fifty cents per million Btu's and including repair costs, to be about the same for each, at $6.30 per ton.

The production of colored glasses, amber, emerald green and light green, appears to be increasing at a greater percentage rate than the production of flint glass. This situation makes it desirable to operate two or more furnaces varying in sizes, if the total market in a particular area is to be served.

Double gobbing has increased in importance and, because of the development of angular shears, nearly all shops in a plant can now be operated double-gob. In-

(*Continued on page 49A*)

Seeds and Fining in Optical Glass Manufacture

By CHARLES F. CALA
Bausch & Lomb Optical Company, Rochester, New York

● OPTICAL GLASS has been made in refractory crucibles for many, many years. Even though this method is now obsolete in modern optical glass manufacturing plants, it is still used in all European and in several domestic plants. A great amount of effort has been spent in improving the type of refractory used because of its extreme bearing on the quality of the glass produced. The compositions of these crucibles are such that even when the refractory is taken into solution by the corrosiveness of the batch, a suitable glass will result. Optical glass when made in open pots usually takes about twenty-four hours from the time the batch is first charged until the glass is ready to be poured and rolled or to be transferred.

Transferring is allowing the glass to cool under positive control until the glass fractures in suitable size pieces for processing. Most optical glasses are melted in the neighborhood of 2650° F. (1450° C.). Batch is added intermittently over a period of about eight hours until the pot is full of molten glass. Fining will take from four to eight hours and the balance of the twenty-four hours is taken up in reducing the temperature of the melt until the glass is viscous enough for either pouring or transferring. This usually takes four to five days. The pieces of glass are then inspected critically and the acceptable pieces are heated and allowed to slump into squares of various sizes. Opposite sides are ground and polished then a second critical inspection in a shadowgraph determines the glass that is of optical quality.

Common optical glasses can be listed in four general classes—borosilicate crowns, ordinary crowns (soda lime), barium crowns and flints. There are over one hundred and fifty common varieties of these general classes. Different types are usually developed to suit the lens designed. It is felt that perhaps in the near future this long list of different glasses will be drastically reduced.

Lens designing in the past has been somewhat of a hit and miss procedure with the ray tracing method. If the result was not as expected, a new glass was usually born. Today's electronic calculators make it possible to use a more analytical approach.

Seeds have always been one of the principal defects in optical glass. This has been such an important factor that different manufacturers have developed various devices to give an indication of the size and frequency of bubbles in each melt. They have listed these figures in much the same fashion as other properties are listed.

The Joint Army-Navy Specification (JAN-G-174) for standard quality optical glass has the following tolerances: The total projected area of all bubbles and seeds on a polished surface, when examined visually, shall not exceed 0.1 per cent of the area of the surface per ten centimeters (3.94 inches) of light path, and the total number of bubbles and seeds shall not exceed one per cubic centimeter (0.061 cubic inches) excepting dense barium crown glass. In dense barium crown glass, the total projected area of all bubbles and seeds shall not exceed 0.2 per cent of the area of the surface per ten centimeters (3.94 inches) of light path and the total number of bubbles and seeds shall not exceed two per cubic centimeters (0.061 cubic inches). In no case shall the mean diameter of any individual bubble exceed 0.5 millimeters (0.021 inches). Glass for special applications may have more rigid specifications than those enumerated.

The fact that optical glasses must be stirred to completely homogenize them, makes the fining more difficult. The continual agitation of the glass with a stirrer has a tendency to keep the bubbles and seeds in solution. It is necessary, therefore, to refrain from stirring for a substantial period of time to allow the glass to fine.

Typical compositions of the various types of optical glasses are as follows:

	BSC	CROWN	DBC	DF
Sand	55%	60%	30%	45%
Potassium	20%	25%	9%	10%
Sodium				
Boron	20%		10%	
Lime		15%		
Barium			45%	
Lead				45%

Today's allowable and typical seed frequency and size for standard quality of optical glass made in pots:

Type	JAN-G Standard Allowable seeds/10cc.	B&L Average Allowable seeds/10 cc.	Seed Size m/m.
BSC	10	.30	.25
C	10	4.50	.20
DBC	20	12.00	.25
BF	10	12.00	.05
DF	10	.20	.10

In general, borosilicate glasses are not too difficult to fine. It is necessary, however, to use higher melting temperatures for this type than for most any other optical glass. Once the glass has been fined, the temperature is dropped very quickly about 300° F.

Ordinary crowns (soda-lime) normally have a few more bubbles. Higher melting temperatures would improve the seed situation drastically but the penalty would be poorer striae quality due to excessive pot attack. A compromise is arrived at which gives good striae quality and reasonable seed quality.

Barium crown glasses have always been very difficult to make satisfactorily. Regardless of the use of high or low temperatures, these glasses are notorious for ex-

(*Continued on page* 50)

Presented before the Fifteenth Conference on Glass Problems, Ohio State University, Columbus, Ohio.

GCMI Meets in Miami Beach

● THE TWENTY-FIRST MEETING of the Glass Container Manufacturers Institute was called to order by its president, Royden A. Blunt on November 29th at the Fontainebleau in Miami Beach, Florida.

Embarkng upon his review of the activities of the Institute and the glass container industry, Mr. Blunt stated that GCMI membership numbered seventy-five companies, comprising glass container manufacturers, closure manufacturers and suppliers. Two new members were announced, the Bartlett-Collins Company, Sapulpa, Oklahoma and the Pennsylvania Glass Sand Corporation, Pittsburgh, Pennsylvania.

Broadly surveying the general business picture with its unprecedented volume of business, Mr. Blunt stated that "Booming consumption standards, coupled with an ever-widening demand for more glass packed items, have culminated in establishing 1955, to date, as a record year for the glass container industry."

In presenting some highlights, Mr. Blunt pointed out that glass containers are "being consumed by the American public on a per capita basis at the astonishing figure of 114 containers per year." As of November first, shipments were 7.2 per cent greater than for the ten months of 1954 and it is expected that glass container shipments will reach a new all-time high this year, even surpassing the 1953 shipment record of 127,516,000 gross.

Concurrent with the increase in shipments this year, the industry has produced 5.6 million gross more than for the same period last year. Later on, during the three day meeting, C. C. Merrifield, vice president of The Econometric Institute, Inc., an independent economic consulting organization addressing the membership estimated total glass container shipments for 1955 at 134,000,000 gross. This amounts to 19,296,000,000 units or 114 per capita. It is an increase of 7 per cent over 1954 shipments of 124,693,000 gross and an increase of 5 per cent over the previous all-time high of 127,516,000 gross scored in 1953.

"Population has increased slightly less than 2 per cent this year," Mr. Merrifield said, "while total consumer purchasing power has increased about 6 per cent. Glass containers have thus shown a substantial per capita gain and improved their position relative to the purchasing power of consumers."

All major grades of glass containers for domestic use showed gains in shipments in 1955 over the 1954 level, the economist told the members.

R. L. Chenney (left), marketing director, Royden A. Blunt, president and Victor L. Hall, general manager, discussing the industry's current promotional program.

Citing an estimated 7 per cent gain in shipments of glass containers to the food industry this year, Mr. Merrifield said, "Since per capita consumption of all food is rising only 1 per cent per year, the gain in shipments of glass food containers in 1955 is roughly twice what would be expected from the population growth and the trend of per capita food consumption.

"Baby foods continue to show exceptionally strong growth and glass packaging is continuing to gain a larger share of that market. The output of salad and cooking oils, also an important market, should show an increase of more than 10 per cent above the 1954 level," he said.

In his forecast for the first nine months of 1956, Mr. Merrifield said, "Under the conditions of higher consumer income and relatively high rate of population growth that are likely, new record levels of shipments of glass containers to the food, medicinal and health, household and chemical, and toiletries and cosmetics industries are likely. In 1955, those end-users accounted for 72 per cent of all glass container shipments.

"Shipments of glass containers to the liquor and wine industries (10 per cent of total glass containers shipped in 1955) are also expected to reach to higher levels in 1956. Soft drink bottles (7 per cent of total glass containers shipped in 1955) are apt to continue close to the higher 1955 rate in coming months.

"Glass containers for beer are the only sizable grade (8 per cent of industry shipments) which are likely to show some loss of market position relative to end-use activity during the first three quarters of 1956. Exports (2 per cent of total glass container shipments) will probably continue close to the 1955 rate.

"Summing up the outlook," Mr. Merrifield stated, "income, employment, population growth and other economic factors are likely to be favorable to the continuation of the excellent gains in glass container shipments that have been evident through 1955. Glass container shipments have increased 171 per cent since 1939—while population has risen 26 per cent and real consumer purchasing power 98 per cent. This relative growth of glass container demand has been due to participation in the growth of such industries as instant coffee, baby foods and soft drinks.

"In the 1930's a major growth element in the glass container industry was returnable beer bottles. To-

(*Continued on page* 52)

Research Digest

The Instrumentation of Glassworks Furnaces

A questionnaire dealing with methods of instrumentation of furnaces was circulated by the Furnace Committee of the Society of Glass Technology to all firms in the United Kingdom which were known to be engaged in glass-melting. The "positive" replies covered substantially more than 90 per cent of the glass-melting capacity of that country. A summary of the present practice and preferred techniques as disclosed by the replies was prepared by D. K. Hill and appears in the August 1955 News and Reviews section of the *Journal of the Society of Glass Technology*.

Measurement and Control of Temperature—The information given by most firms related to the equipment and methods which they themselves use. Where suggestions were made as to the "best" methods of furnace-temperature measurement, all included the use of thermocouples in the furnace superstructure and of a disappearing filament optical pyrometer to give a frequent periodic check.

In the case of total-radiation pyrometers their usage is given in Table 1.

Table I
Total-Radiation Pyrometer Usage

Installation and Location	Tank furnaces	Pot furnaces
(a) Sighted directly into furnace through open tubes	3 (regenerative)	—
(b) Sighted into closed-end refractory tubes..		
(I) Side walls melting end	10 (regenerative)	
(II) Side walls working end	4 "	
(III) Gable wall	4 "	
(IV) Crown	1 (recuperative)	2 (recuperative)
(V) Wall	—	
(VI) Location not stated		1 "
	1 (regenerative)	2 "
	—	—
	23	5
Total No. of installations		28

The effects of smoke, oil vapor, atmospheric dust, changes in flame direction, etc., on this type of instrument have been considered very seriously by a number of commentators. It is clear that in a number of cases the location of the pyrometer has been decided, not on the basis of measuring the highest temperature or indeed any particular temperature, but for ease of accessibility to operators for routine cleaning of the mirrors, lenses and windows of the instruments. It is pointed out that if the pyrometer is positioned so that smoke or oil vapor can drift between the telescope and the refractory tube, then erratic readings are to be expected. Further, if the pyrometer is located in the end-wall of a cross-fired furnace, then the readings may be affected by drifting batch and by flame reversal.

For accessibility, some use radiation pyrometers in the end wall. Two report their use on each side of the doghouse, connecting the two instruments in series so as to minimize fluctuations due to changeover, etc. Similarly, another reports using radiation pyrometers sited in the sidewalls so arranged that only the instrument in the downtake side of the furnace is in circuit at any time.

A practical difficulty with open-end refractory tube installations is that of avoiding direct or indirect flame interference along the sighting line. In general, the comparative stability afforded by the closed-end tubes has been an important factor in deciding the type of installation.

Table II
Noble-metal Thermocouple Usage

Location	Tank furnaces	Pot furnaces
Crown (regenerative)	13	—
" (recuperative)	2	2
Sidewalls or walls	4 (regenerative)	4 (recuperative)
Immersed	5	—
Occasional use (crown)	—	1 (recuperative)
	24	7
Total No. of Installations		31

The usage of noble-metal thermocouples is given in Table II. Most of the firms which used thermocouples in tank furnaces express a strong preference for having a number of thermocouples along the furnace crown or along the side-walls. At very high temperatures thermocouples may lose their calibration fairly rapidly. In most cases, however, any significant changes in calibration were detected by optical pyrometer measurements.

Optical pyrometers of the disappearing filament type seem to be used extensively for checking. It is important to check the calibration of a disappearing filament optical pyrometer at regular intervals.

The majority recorded the furnace temperatures, both melting zone and working zone, as it was felt that the rate of change is more apparent from a record. The preferred type of instrument was either (a) for a mechanically-operated potentiometric instrument, perferably with an open scale, or (b) for an electronically-operated potentiometric instrument, again with a wide chart.

On the question of automatic temperature control the replies are summarized in Table III. A number of operators stress that full advantage of automatic temperature control can be obtained only by linked control of pressure and other variables and that provision for the rapidly varying conditions or change-over is desirable. Main advantages claimed for automatic temperature controls are, economy in fuel and steady furnace conditions.

Thirteen firms reported that temperature measurements are made in the regenerator system. The regenerator bottom temperature is used in some cases to control reversals, either automatically or by some warning system. Some difficulty is found in measuring the temperature at the top of the regenerators because of pronounced slagging of the sheaths of thermocouples, although a number

(*Continued on page* 54)

Inventions and Inventors

Feeding and Forming

Method of Reshaping Tubular Stock. Patent No. 2,711,055. Filed June 25, 1952. Issued June 21, 1955. Two sheets of drawings (None reproduced). Assigned to International Telephone and Telegraph Corporation by Charles P. Majkrzak and Ernest R. Jones.

This invention relates to the art of producing glass envelopes and more particularly to a method for making glass envelopes for electronic discharge and gaseous discharge devices of various shapes and sizes from tubular stock. A feature of this invention is the employment of a split carbon mold of the desired internal configuration having a tapered opening into which tubular stock having a closed end is fed, under pressure, as the glass stock is heated preferably by means of an induction heating coil surrounding the mold. A pressure regulated source of compressed air is employed to accomplish the blowing operations which forms the thermally softened tubular glass stock to the configuration of the selected carbon mold. The envelopes thus formed are used for electron and gaseous discharge devices in which the wall thickness is substantially free from faults that would rupture when exposed to a vacuum or gaseous pressure.

The patent contains four claims and the following references were cited: 406,692, Atterbury, July 9, 1889; 1,859,011, Wales, May 17, 1932; 2,151,874, Simons, Mar. 28, 1939; 2,345,670, Heath, Apr. 4, 1944; 2,419,864, Westin, Apr. 29, 1947; 2,452,197, Kennedy, Oct. 26, 1948; 2,597,237, Friend, May 20, 1952; and 495,376, Great Britain, Nov. 7, 1938.

Method of Sealing a Vacuum Vessel Having a Thick-walled Exhaust Tube. Patent No. 2,714,785. Filed October 29, 1951. Issued August 9, 1955. One sheet of drawings; none reproduced. Assigned to Hartford National Bank and Trust Company by Wilhelmus Antonius Roovers.

A method of sealing a thick-walled glass exhaust vessel such as a cathode-ray tube is shown. The vessel is first evacuated through an exhaust tube and pump after which it is locally heated to fuse a portion of the walls, leaving a superfluous portion of the tube remaining attached to the sealed portion. Heat is then immediately applied electrically to only a portion of the exhaust tube adjacent to the sealed portion on the side adjacent to the vessel to prevent stresses from being produced in the sealed portion during cooling. After cooling the superfluous portion is mechanically removed, leaving a sealed exhaust tube free of protuberances.

There are five claims and 8 references cited in this patent. 1,572,873, Allcutt, Feb. 16, 1926; 1,977,671, De Neumann, Oct. 23, 1934; 2,014,471, De Neumann, Sept. 17, 1935; 2,055,981, Magnien, Sept. 29, 1936; 2,248,647, Strickland, July 8, 1941; 2,262,760, Gardner et al., Nov. 18, 1941; 2,278,500, Smith, Apr. 7, 1942; and 557,738, Great Britain, May 29, 1946.

Cathode-Ray Tube Sealing Apparatus. Patent No. 2,715,298. Filed October 19, 1949. Issued August 16, 1955. One sheet of drawings; none reproduced. Assigned to The Rauland Corp., by Albert Louis Buttino.

This invention relates to improved apparatus for the fabrication of cathode-ray tubes of the type having an envelope comprising a neck portion of vitreous material such as glass, a metallic conical portion, and a transparent window or viewing plate of glass or similar transparent plastic.

This invention provides apparatus for fabricating envelopes of cathode-ray tubes in which the conical portion of the envelope is held with its axis in a vertical position and the neck and window portions thereof sealed to the conical portion while it is in this position, thus enabling a single mechanism to carry out the sealing together of these portions.

There were 7 claims and 5 references cited in this patent. 829,538, McDonnell, Aug. 28, 1906; 1,461,155, Madden et al., July 10, 1923; 1,779,311, Gates, Oct. 21, 1930; 1,869,533, Wetmore, Aug. 2, 1932; and 2,477,332, Garbe, July 26, 1949.

Machine for the Manufacture of Hollow Glass Articles. Fig. 1. Patent No. 2,704,418. Filed February 27, 1951. Issued March 22, 1955. Five sheets of drawings. Assigned to Automatic Glassware Machinery Company Ltd. by Lucien J. Gerbaud.

In the manufacture of hollow glass articles having a comparatively wide opening, it is necessary to mould the

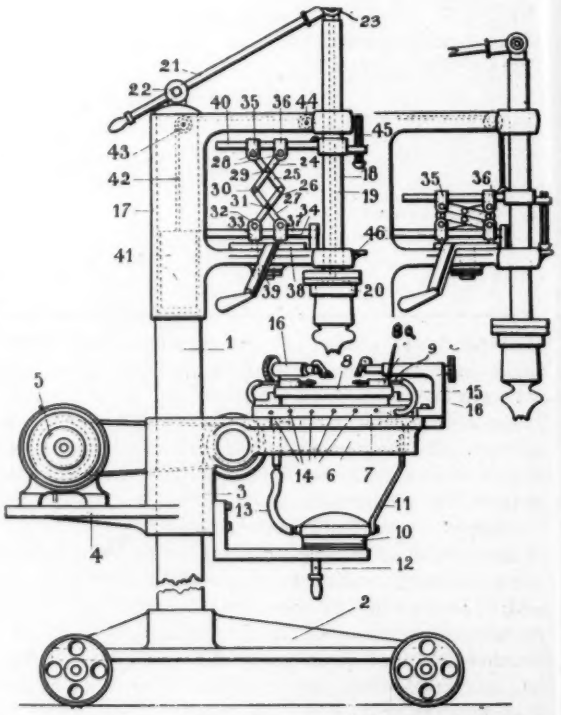


Fig. 1

articles by forming an extension thereon, the diameter of which tapers towards its end in order that the blowing of the article may be executed more conveniently; this extension should then be cut off so as to give the article its final length and to shape at the same time the opening therein. It is possible to separate, at raised temperature or at room temperature, the extension from the finished article. The machine illustrated in Fig. 1 includes a central upright 1 mounted on the carriage 2. The machine is further provided with an annular carrier 6, inside which is revolubly fitted a rotary annulus 7, carrying a further annulus 8 provided with radially bored bosses 8a carrying in their turn a number of burners or blow pipes 9, each of which is slidably mounted along its axis. To the annual non-rotary carrier 6 are secured carrier members 16 adapted to hold the projecting shoulder portion of the glass article during the drawing operation. The rod 18 should assume a very rapid vertical movement. In order to obtain the high speed required we resort to an expansible lazy tongs raising device including the members 24, 25, 26, 27 that are assembled through pivotal axes such as 28, 29, 30, 31, 32; the members form with one another a system of pivotal link motions or a toggle joint. The ends of this lazy tongs movement are connected with the sliders 33, 34, 35, 36; of these, the lower sliders 33 and 34 are carried by a stationary slideway or rod 37; they are controlled by a spirally grooved cam 38 through the agency of a handle 39 that constrains them to be shifted horizontally toward or away from each other over the slideway. The upper sliders 35 and 36 move of necessity in synchronism with the sliders 33 and 34 but, as they are carried by a slideway or rod 40, that is rigidly secured to the vertical rod 18, there is provided through the spacing of the sliders 33 and 34 a gradual collapse of the lazy tongs movement which leads to an immediate downward movement of the rod 18, while the reverse movement of the sliders allows obtaining an upward movement of the rod 18 at an equally high speed.

The patent contains six claims and the following references were cited: 2,334,111, McNamara et al., Nov. 9, 1943; 2,361,824, Dorman, Oct. 31, 1944; 2,513,542, Wohinc, July 4, 1950; 2,554,339, Lilja et al., May 2, 1951; and 829,261, France, June 17, 1938.

Furnaces

Glass Furnace. Fig. 2. Patent No. 2,704,419. Filed June 29, 1950. Issued March 22, 1955. Three sheets of drawings. Assigned to Laclede-Christy Company by Lowell C. Hewitt and Austin J. Paul.

The present invention relates to a novel glass furnace and to a novel type of fire clay tank block in the refining end and below the metal line in the melting end of the furnace. As shown in Fig. 2, the glass furnace contains a melting end 10 and a refining end 12 which are connected together by a trough-like portion 14. The melting end 10 is roughly rectangular in shape and includes side walls 16, end walls 18 and a bottom 20. The bottom 20 comprises a single layer of horizontally disposed, abutting, fire clay blocks 22 which contain more than 37 per cent alumina and preferably about 52 per cent alumina. The side and end walls 16 and 18, respectively, comprise a single layer of vertically disposed, abutting,

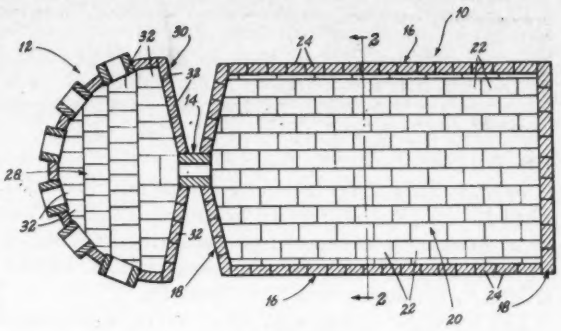


Fig. 2

fire clay blocks and are at least two blocks high, there being one series of blocks 24 at the metal line and at least one other series of blocks 26 (not shown) below the blocks 24. The blocks 24, which are at the metal line, contain less than 42 per cent alumina and the blocks 26 contain more than 37 per cent alumina and preferably about 52 per cent alumina. The refining end 12, which is roughly semi-circular in shape, includes a bottom 28 and side walls 30, both of which are formed of a single layer of fire clay blocks 32. The blocks 32 in the side walls 30 at the metal line and below the metal line, and the blocks 32 in the bottom 28 contain more than 37 per cent alumina and preferably about 52 per cent alumina.

The patent contains 4 claims and 13 references.

Glass and Wool Fibers

Coating Glass With A Titanium Polymer. Patent No. 2,710,267. Filed June 17, 1950. Issued June 7, 1955. No drawings. Assigned to Monsanto Chemical Company, by Thomas Boyd and Robert M. Dickey.

It is frequently desirable to coat glass articles such as fibers, filaments, bats, fabrics, sheets, windshields, lenses, etc. to change the surface characteristics of the glass. For some purposes, the coatings should act as lubricants; for others as a non-fogging agent; for still others as a non-reflecting surface, etc., the coatings should be easy to apply. Many coating materials have been suggested, most of which are deficient in one or more of the critical features desired.

A glass filament is prepared by the conventional process of forcing molten glass through a small orifice into cool air. Thereafter, the filament is passed through a toluene solution of a polymer of tetrabutyl ortho titanate containing about 1 per cent polymer by weight. The speed of the coating operation is governed so as to deposit on the glass a film of pclymer about 0.1 mil thick. The coated filament is then passed through a humid atmosphere at room temperature (20-35° C.). The resultant coated filament is not wetted by water or other aqueous media. The coating is nearly as hard as the glass but is still flexible enough so that the glass filament can be woven or prepared into glass mats without disrupting the coating. On testing the tensile strength of the coated filament and comparing the results with tests made on the uncoated filament, it is found that there is substantially no change.

There were 13 claims and 6 references cited in this patent. 2,466,642, Larsen, Apr. 5, 1949; 2,530,635, Sowa,

Nov. 21, 1950; 125,450, Australia, Sept. 12, 1947; and *Ellis, The Chemistry of Synthetic Resins*, vol. 2, 1935, Reinhold Pub. Corp., New York City, N. Y., pg. 1239. *Journal Oil & Colour Chemists Assn.*, Vol. 31, No. 340, 1948, pp. 405-410. *Esters of Titanium* by Kraitzer, K. McTaggart and G. Winter.

Bonded Glass Fiber Product. Patent No. 2,717,841. Filed January 9, 1951. Issued September 13, 1955. One sheet of drawings (none reproduced). Assigned to Owens-Corning Fiberglas Corporation, by L. P. Biefeld, and M. C. Armstrong, and R. F. Shannon.

This invention relates to the manufacture of panels and boards based upon glass fibers bonded with an inorganic cement and which is characterized by hardness, strength and by porosity throughout, to enable use of the board as insulation, lath, roof decking, heat barriers, structural board and the like.

A glass fiber layer having a density of about 7 pounds per cubic foot, formed of wool fibers bonded with phenol formaldehyde resin, is pre-wet with a 0.5 percent solution of the sodium salt of alkyl naphthalene sulfonic acid (wetting agent). A slurry composed of 100 parts by weight calcined brucite, 150 parts by weight water, 150 parts by weight magnesium sulphate ($MgSO_4.7H_2O$) and 1.25 parts by weight sodium salt of alkyl naphthalene sulfonic acid is homogenized in a mixer and fed down a sluiceway onto the surface of the bonded glass fiber layer as it travels in one direction. The layer is then passed over a suction chamber which withdraws slurry over and above the amount that is desired to have remain in the board. By proper regulation of suction and duration thereof, as well as by formulation of the slurry, the amount of binder that remains and the porosity, hardness and density of the board can be easily controlled.

Boards having a density in excess of 15 pounds per cubic foot are produced ranging on up to hard, rock-like, though porous boards having a density of 30-35 pounds per cubic foot.

There were 14 claims and the following references were cited in this patent. 2,208,232, Smolak, July 16, 1940; 2,444,347, Greger, June 29, 1948; 2,500,665, Courtright, Mar. 14, 1950; 2,546,971, Byrns, Apr. 3, 1951; 2,598,890, Denning, June 3, 1952; and 2,610,957, Steinman et al., Sept. 16, 1952.

The Condensed Chemical Dictionary, 3rd ed. Reinhold Pub. Co. 1942, pgs. 173-174. Plastic Magnesia Cements, The Dow Chemical Co. 1927, pgs. 66 and 67.

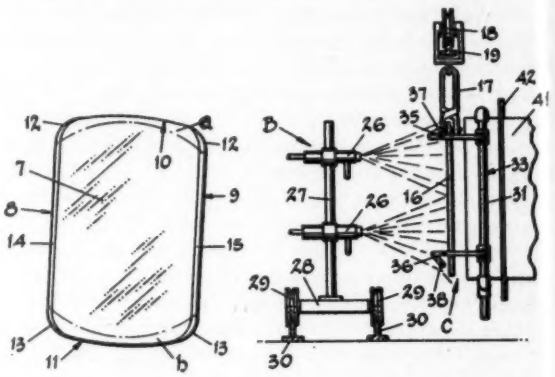
Sheet and Plate Glass

Automatic Glass Grinding Machine. Patent No. 2,704,425. Filed July 7, 1954. Issued March 22, 1955. Eight sheets of drawings (non reproduced). Pierre de Vitry d'Avaucourt.

This invention relates to an automatic generating machine and is concerned more particularly with a machine for generating surfaces on lens blanks and the like. The machine is designed to deliver lens blanks from a magazine or stacker onto the lens chuck, automatically generate the desired surface on the lens blank and reduce the blank to the proper thickness. It also automatically picks the ground lens from the lens chuck and automatically discharges them. The essential features are said to reside in first, a blank feeding or delivery mechanism; second, an automatic lens picking and discharging mechanism; and third, a control mechanism for energizing the various operations in sequence and in a fully automatic manner. The machine also provides automatic means for performing a series of sequential operations upon initial actuation of the machine, with the completion of the last of the operations again initiating the sequence regardless of the time interval between the operations.

The patent contains fifteen claims and no references.

Transparent Electrically Conducting Unit. Fig. 3. Patent No. 2,703,767. Filed May 21, 1951. Issued March 8, 1955. One sheet of drawings. Assigned to Libbey-Owens-Ford Glass Company by Thomas K. Young.



It is an object of the invention to attain uniformity of temperature throughout the area of an electrically conducting film upon an irregular shaped glass base by controlling the current flow in the film. After the glass sheet 16 has reached substantially its point of softening within a furnace, it is directed forwardly from there by means of the carriage 18 and positioned in front of the filming apparatus B and cooling means whereby the heated sheet 16 is suspended substantially centrally of the framework 33. In this position, the upwardly directed sections 37 of the pair of tubes 35 and downwardly directed sections 38 of the pair of tubes 36 are angularly arranged to distribute a stream of air not only upon the curved ends of the electrodes 14 and 15, but also across an area of the glass sheet extending outwardly of the phantom lines indicated in Fig. 3. Upon reaching the position above indicated, the glass sheet 16, and specifically the ends of the electrodes and areas a and b bounded by the phantom lines, are subjected to streams of air for a period of approximately 25 seconds, the air supply is shut off, and the coating solution is caused to be sprayed onto the entire surface of the sheet from the guns 26. Thus, the areas a and b of the glass sheet and ends of the electrodes 14 and 15 are cooled prior to the deposition of the tin halide solution thereon to lower the temperature of these areas, render the predetermined portions relatively less receptive to a uniform film of tin oxide and thus reduce the amount of deposit. This is so because an effective and uniform film of tin oxide can best be deposited upon a glass surface which is substantially at its point of softening, and thus, when the tem-

(*Continued on page 40*)

New Equipment and Supplies

AUTOMATIC LUBRICATOR FOR MONOFLO CONVEYOR

The M-H Standard Company, 515 Communipaw Avenue, Jersey City 4, New Jersey, announces an automatic lubricator for its Monoflo Rotating Cable Conveyor.

It consists of a 1 ounce transparent oil reservoir with an adjusting knob to control rate of oil flow, a snap action flow valve and a sight glass to check rate of flow. In operation, the counterweight frame of the lubricator positions the feed nozzle directly over the cable.

To lubricate the Monoflo cable, it is simply necessary to snap open the valve and hang the lubricator over the rotating conveyor. The lubricator travels to the end of the conveyor, dispensing a measured amount of oil along the entire length. The lubricating operation is finished in minutes and can be performed while the Monoflo is conveying a full load of parts.

NEW SINGLE STRIP TAPE SEALER FOR CONTAINERS

General Corrugated Machinery Company, Palisades Park, New Jersey announces a new single strip tape sealer for containers. This machine automatically tapes 25 or more cases per minute, single-strip, top and/or bottom flaps only, plus end-panels, as required. The machine is engineered and manufactured by General Corrugated Machinery Company and has a minimum length of seven feet.

NEW ANNEALING LEHR

Surface Combustion Corporation, Toledo 1, Ohio have especially built the 5 feet x 90 feet long annealing lehr, shown above, for the facilities of the new $5,000,000 Owens-Illinois Technical Center in Toledo. It is believed to be the largest annealing furnace ever constructed for use exclusively as an experimental tool. This lehr anneals various glass products such as experimental TV picture tube bulbs.

It is designed to operate at temperatures to 1050°F., and employs three large fans to provide effective recirculation to meet precise temperature control requirements along the entire length and width of the belt.

AUTROMETER MAKES CHEMIST'S JOB EASIER

North American Philips Company, Inc., Research & Control Instruments Division, 750 South Fulton Avenue, Mount Vernon, New York has announced the development of a new improved Norelco Autrometer, multi-element indexing X-ray spectrograph. This instrument covers a range of 71 elements in the atomic scale and gives percentages of as many as 24 in a specimen.

Program selectors are provided for the indexing positions so that data on individual elements may be obtained in sequential order. Any one or more of the positions may be by-passed in an analysis operation by switching off the proper selectors. After a sequence is completed, selector settings may be retained for use on similar specimens or may be changed to accommodate different conditions. All operations are handled from a console desk.

The goniometer has been designed for automatic scanning. Each indexing position can be adjusted for maximum intensity level on a given element and a ratemeter is provided to facilitate such settings. At the end of a cycle, the goniometer repositions itself to zero and rests until a new operating sequence is initiated. There is no limitation on the minimum angular spacing between adjacent element positions. When necessary, they may be set a fraction of a degree apart. A horizontal metal disc rotates inside a leaded-bronze ray-proofed housing and serves to transport specimens into the path of the X-ray beam. The disc rotates on a shaft that extends through the top of the housing and a knob permits manual control by the operator. The disc has two openings that accommodate specimen holders measuring $1\frac{3}{8}$ inches in diameter by $1\frac{3}{8}$ inches deep. One holds the standard, the other the unknown.

In the new design, the X-ray beam strikes specimens from below and this facilitates work with liquids. The instrument is built to accommodate helium in the X-ray path and scintillation or proportional counters may be used for detection. A scintillation counter is normally employed because it has high resolution, indefinite count life, negligible dead time and a wide spectral sensitivity for all wave lengths.

The Autrometer functions automatically once the standard and unknown specimens are in place and the specimen disc has been turned manually to operating position. Two separate cabinets are used to house the Autrometer.

CATALOGS RECEIVED

Johns-Manville, 22 East 40 Street, New York 16, N. Y. have issued the "Johns-Manville Products Handbook", a new 52-page publication featuring eleven lines of the J-M products for industry—insulations and refractory products, electrical products; synthetic silicates, etc.

The handbook contains not only product descriptions and essential engineering data but also a great deal of related information. For example, on the subject of thermal insulation problems, methods of calculating heat transmission are given, etc. Copies of the handbook are available on request.

Current Statistical Position of Glass

Employment and payrolls: Employment in the glass industry during October 1955 was as follows: *Flat Glass:* A preliminary figure of 30,100 for October 1955 indicates a rise of only 1.3 per cent from the adjusted 29,700 reported for September 1955. *Glass and Glassware, Pressed and Blown:* A decrease of 1.3 per cent is shown by the preliminary 81,600 figure of October 1955 when compared with 82,700 of September 1955. *Glass Products Made of Purchased Glass:* The preliminary 15,300 indicates a rise of only 0.6 per cent from the previous month's.

Payrolls in the glass industry during October 1955 were as follows: *Flat Glass:* A decrease of 1.2 per cent is shown in the preliminary $14,681,576—when compared with September 1955 adjusted figure of $14,858,414. *Glass and Glassware, Pressed and Blown:* A drop of 1.1 per cent is shown in the preliminary $26,799,072—reported for October 1955 when compared with the previous month's adjusted $27,099,681. *Glass Products Made of Purchased Glass:* A preliminary figure of $4,560,777 was reported for October 1955. This is 3.6 per cent higher than the adjusted September 1955 figure of $4,401,210.

GLASS CONTAINER SHIPMENTS
(All Figures in Gross)

Narrow Neck Containers

	November 1955
Foods	931,000
Medicinal & Health Supplies	1,217,000
Chemicals, Household & Industrial	703,000
Beverages, Returnable	418,000
Beverages, Non-returnable	53,000
Beer, Returnable	99,000
Beer, Non-returnable	490,000
Liquors	948,000
Wines	398,000
Toiletries & Cosmetics	740,000
Sub-total (Narrow)	5,997,000

Wide Mouth Containers

Foods	*2,836,000
Dairy Products	237,000
Medicinal & Health Supplies	390,000
Chemicals, Household & Industrial	136,000
Toiletries & Cosmetics	130,000
Packers' Tumblers	119,000
Sub-total (Wide)	3,848,000
Total Domestic	9,845,000
Export Shipments	272,000
TOTAL SHIPMENTS	10,117,000

* This figure includes Fruit Jars and Jelly Glasses.

GLASS CONTAINER PRODUCTION AND INVENTORY
(All Figures in Gross)

		Production November 1955	Stocks November 1955
Foods; Medicinal & Health Supplies; Chemicals, Household & Industrial: Toiletries and Cosmetics	Narrow Neck	3,841,000	4,628,000
	Wide Mouth	*3,750,000	*4,772,000
Dairy Products		233,000	308,000
Beverages, Returnable		516,000	1,278,000
Beverages, Non-returnable		52,000	237,000
Beer, Returnable		119,000	295,000
Beer, Non-returnable		539,000	733,000
Liquors		913,000	1,175,000
Packers' Tumblers		120,000	172,000
Wines		474,000	525,000
TOTAL		10,557,000	14,123,000

* This figure includes Fruit Jars and Jelly Glasses.

Glass container production, based on figures released by the Bureau of Census, dropped 13.3 per cent during November 1955 to reach a low 10,557,000 gross. This is a decrease from the previous month's 12,173,000 gross. During November 1954, production was 9,252,000 gross, or 12.3 per cent below November this year. Glass container production at the end of the first eleven months of 1955 has reached a total of 126,095,000 gross, which is 8.6 per cent ahead of the 116,166,616 gross produced during the same period in 1954.

Shipments of glass containers during November 1955 dropped 11.3 per cent to reach 10,117,000 gross. This is a decrease from October 1955 shipments which were 11,425,000 gross. Shipments during November 1954 were 9,451,000 gross, or 7 per cent below November 1955. At the end of the first months of 1955, glass container manufacturers have shipped a total of 123,640,000 gross, which is 9.3 per cent ahead of the 113,056,195 gross shipped during the corresponding period last year.

Stocks on hand at the end of November 1955 were 14,123,000 gross. This is only 3 per cent above October 1955 stocks of 13,719,000 gross and 5.2 per cent higher than the 13,423,000 gross on hand at the end of November 1954.

Automatic tumbler production during October 1955 was 5,819,325 dozens. This is an increase of 38 per cent from September 1955 production which was 4,220,967 dozens. Production during October 1954 was 5,780,393 dozens. Shipments during October 1955 rose to reach 6,443,237 dozens. This is 40.5 per cent higher than September 1955 4,586,929 dozens. During October 1954, shipments were 6,270,215 dozens. At the end of the 12-month period ending October 31, 1955, shipments have reached a total of 61,986,754 dozens, which is 1 per cent higher than the 61,374,139 dozens shipped last year.

Table, kitchen and household glassware: Manufacturers' sales of machine-made table, kitchen and household glassware during October 1955 rose 21 per cent to reach 4,125,423 dozens. This is an increase from September 1955 3,406,369 dozens. During October 1954, sales were 4,175,224 dozens. At the end of the 12-month period ending October 31, 1955, manufacturers had sold a total of 37,785,534 dozens, which is only slightly above the 37,345,171 dozens sold during the corresponding 1954 period.

Mr. William Snell, vice president, Anchor Hocking and Mrs. Earl Flatter.

OVERMYER MOULD COMPANY'S NINTH ANNUAL SERVICE AWARDS BANQUET

Overmyer Mould's Ninth Annual Service Awards Banquet was held at Beeson Club House last night and was attended by 136 OMCO employees and guests. The entire program was conducted in the usual informal manner, which contributed to a highly successful program.

Immediately following dinner, E. R. Flatter, vice president of OMCO, introduced the guests of honor. They were: Clayton R. Braunagel, Federal Bureau of Apprenticeship Rep.; Robert Miles, president, Foundry Workers Local No. 24; Jack Skinner, president, A.F.G.W.U. Local No. 112; Dale Rouch, president, A.F.G.W.U. Local No. 518; Harry Willits, president, Pattern Makers Local; Mr. Donald Matthews, plant manager, Anchor Hocking, accompanied by Mrs. Matthews; James Kindelan, plant manager, Overmyer Mould Co. of Pennsylvania; and Robert Kist, editor, Winchester News and Journal Herald.

The last guest of honor and speaker of the evening was William Snell, vice president, Anchor Hocking Glass Corporation. Mr. Snell selected as his topic, "Service Award—What Does It Mean." In keeping with the informal tone of the occasion, Mr. Snell offered his observations gained from a lifetime of working with people. As a practitioner of human relations, Mr. Snell recognized that there are many obstacles to overcome by both men and women as they begin a new job. A person's initial exposure to a new job brings about certain reactions such as doubt, discontent, disappointment and probably, at times, a certain amount of unhappiness. Very often the understanding of management and the determination of the individual to see things through enables him to overcome the initial reactions and better evaluate the opportunities which his employment offers for his personal advancement and security of his family.

Mr. Snell paid tribute to those employees who had successfully overcome the obstacles in their path, as attested by the many impressive service records of Overmyer employees.

Award presentations were made by company officials in the following order. Lapel pin awards for 10 years of service were presented by Max Hawkins, sales manager. Lapel pin awards for 15 years of service were presented by Vernon Ruble, Mould Division superintendent. Lapel pin awards for 20 years of service were presented by E. R. Flatter, vice president. Lapel pin awards for 30 years of service were presented by Charles Manrose, secretary-treasurer.

The highlight of the evening was the presentation of engraved Hamilton wrist watches and lapel pins for 25 years of service. In keeping with custom, the wives participated in the ceremony. Awards were presented by Company President, Lowell Roesner, to the following couples, Mr. & Mrs. Donald Denney, Mr. & Mrs. Campbell Jones, Mr. & Mrs. Lester Brown, and Mr. & Mrs. James Stoker.

The last group to receive awards were fifteen Journeymen who completed a four-year apprentice program during 1955. Department of Labor Certificates were issued by E. R. Flatter.

The program contained a memoriam to C. P. Overmyer, Sr. and Donald P. Strahan, deceased members of the Overmyer 25-Year Club.

W. J. F. FRANCIS ELECTED VICE PRESIDENT—SALES

The appointment of W. J. F. Francis as vice president in charge of sales for American Potash & Chemical Corporation, was announced by Peter Colefax, president, at company headquarters in Los Angeles.

Mr. Francis has been Western general sales manager of the Company since December, 1952, after coming to the organization from Pennsylvania Salt Manufacturing Company, Tacoma, Washington and previous experience with California Spray-Chemical Corporation, Richmond, California. He has served in the past on various agricultural chemicals OPS-NPA industry advisory committees in Washington, D. C. He will continue to make his offices at Los Angeles.

Ed M. Kolb will continue in charge of Eastern activities as Eastern general sales manager, and William Clines has been promoted to Western sales manager from Western sales manager, heavy chemicals.

WILLIAM H. EVANS ELECTED TO BOARD OF DIAMOND ALKALI

Williams H. Evans, a vice president of Diamond Alkali Company, Cleveland, Ohio, was elected to the board of directors at a board meeting held at the Company's national headquarters.

During his 18 years' service with the company, Mr. Evans at various intervals has held a number of key executive posts, including that of treasurer.

For six years prior to his promotion to a vice presidency in June, 1954, he had been manager of the Company's nation-wide sodium silicate operations, which encompass six plants producing basic silicates and specialized derivative chemical products.

● Carl F. Brown, 65, Insurance and Property Manager of Anchor Hocking Glass Corporation, Lancaster, Ohio, passed away December 1, 1955, following a brief illness. Mr. Brown was identified with Anchor Hocking or its affiliates for forty-one years.

WILLIAM MURPHY, AMERICAN POTASH EXECUTIVE DIES AT 60

William J. Murphy, 60, a vice president and director of American Potash & Chemical Corporation, died December 11 at Community Hospital, Montclair, New Jersey. He lived at 15 Columbus Avenue, Glen Ridge, New Jersey.

Mr. Murphy joined the American Potash & Chemical organization on October 6, 1911, at the age of 16. He worked in New York in various capacities until June of 1917, when he was assigned to the San Pedro Refinery until that operation was discontinued. After a period in the Los Angeles office, he went to Trona, in January 1919. His progress was steady—manager of Borax Sales in 1926, general sales manager in 1934, vice president in charge of sales in 1941 and, finally, elevation to the board of directors in 1947. During the World War II years, he was a member of four industry advisory committees to the agencies of the Government.

He was a director of the National Plant Food Institute, the American Potash Institute and of the American Potash Export Association. He was a member of the Union League Club of New York, the Belair Bay Club of California and the Glen Ridge Country Club.

He leaves his wife, Mrs. Marie Sullivan Murphy; two sons, William J., Jr. of Wellesley, Mass., and Richard A. of Glen Ridge; a brother, John J. Murphy of Springfield Gardens, L. I.; a sister, Mrs. Rose Callow of New York, and seven grandchildren.

PLANS FOR NEW RESEARCH CENTER FOR L.O.F. GLASS FIBERS COMPANY

Plans for a new "Research Center" and executive personnel appointments in the research department of the L.O.F Glass Fibers Company were announced by R. H. Barnard, president.

The new building will be the "nerve center" of research facilities which now total over 32,000 square feet. These facilities are located at Waterville, Ohio, near the company's textile yarn and bonded mat manufacturing plant. Work will begin immediately at the Waterville site.

Dominick Labino has been appointed vice president and director of research of the company, Mr. Barnard said. Until the appointment, he had been vice president in charge of glass research and process development.

Mr. Barnard also appointed Ellsworth Smith, formerly new product manager in the general engineering department, as technical director and Vernon Waltz, Jr., the Waterville plant accounting department, as service manager of the new research center.

The new center will contain offices for the research director and other executive personnel, a glass testing and development laboratory, plastics laboratory, meeting room and library. It will be fully air conditioned.

GEORGE F. LANG, HEAD OF CARR-LOWREY GLASS, DIES AT 71

George F. Lang, of the Carr-Lowrey Glass Company of Baltitmore, died November 30, at the age of 71.

Mr. Lang was president of the Carr-Lowrey Glass Company and a member of the board of directors of the Anchor-Hocking Glass Corporation, of Lancaster, Ohio. He was also president of Swindell Brothers, Inc., and of Glass Crafters, Inc., besides holding amongst his many other offices a directorship of The Savings Bank of Baltimore, the United States Fidelity and Guaranty Company, the Mercantile-Safe Deposit and Trust Company, all of Baltimore.

He was a national figure in the glass industry, a founder and the first president of the Glass Container Manufacturers Institute. After his presidency he served for many years as a trustee of the institute.

Between 1951 and 1954 Mr. Lang was a member of Governor McKeldin's Advisory Council on Highway Construction, working with fellow council members in the development of Maryland's 12-year road-building program as well as for the advancement of plans for the Baltimore harbor tunnel.

Born in Baltimore and educated in public schools, Mr. Lang started in a position with the National Central Bank of Baltimore. His association there continued for 25 years until he resigned as a vice president in 1926 to become vice president of the Carr-Lowrey Glass Company. He had been president there since 1931.

Mr. Lang is survived by his wife, Mrs. Marion Gift Lang; a daughter, Mrs. David J. Dunigan, Jr., of Washington; four sisters and three grandsons.

WYANDOTTE ENLARGES ALPENA QUARRY

A multi-million dollar program for the enlargement and modernization of its Alpena Michigan quarry was announced by Wyandotte Chemicals Corporation's president, Robert B. Semple.

The Alpena quarry produces limestone for use in the company's chemical manufacturing plants in Wyandotte, Michigan and for the Huron Portland Cement Company's mill at Alpena.

"Plans call for the installation of new primary and secondary crushers on the quarry floor," stated Mr. Semple, "and installation of the latest type of conveyor equipment to move the crushed rock to the surface."

Installation of the new primary and secondary crushers, conveyors and screening equipment will commence early in 1956 and is scheduled for completion in the Spring of 1957.

● Indiana Glass Company has opened its own branch office in New York City at 1107 Broadway. Mr. Raymond E. Haskell has been appointed vice president in charge of sales and will maintain offices at the branch office in New York City.

ANCHOR HOCKING SUBSIDIARIES ELECT NEW OFFICERS

W. V. Fisher, president of Anchor Hocking Glass Corporation, Lancaster, Ohio, has just announced the election of the following officers for the Anchor Hocking subsidiary, Carr-Lowrey Glass Company and for Carr-Lowrey's subsidiary, Swindell Brothers, Inc., both of Baltimore, Maryland.

J. H. Funkey

C. R. Hilgenberg

John H. Funkey was elected president of Carr-Lowrey Glass Company, filling the vacancy created by the death recently of George F. Lang. Mr. Funkey also was elected president and a director of Swindell Brothers, Inc. He was formerly a vice president of Carr-Lowrey Company, and has been with the company since 1932.

C. R. Hilgenberg was elected treasurer of Carr-Lowrey, in addition to his present offices of vice president and secretary, which he continues to hold. Mr. Hilgenberg joined the company in 1929.

J. J. Jeffries

W. J. Burt

J. J. Jeffries, vice president and secretary of Swindell Brothers, Inc., was elected assistant treasurer of Swindell, in addition. Mr. Jeffries started with Swindell Brothers, Inc., in 1910.

W. J. Burt, assistant secretary of Carr-Lowrey Glass Company, was also elected assistant treasurer of Carr-Lowrey. Mr. Burt has been with the company twenty-eight years, starting in 1927.

Cryrus L. Fulton, vice president in charge of finance for Anchor Hocking Glass Corporation and an Anchor Hocking director, was elected a director of Carr-Lowrey Glass Company and a director of Swindell Brothers.

EXECUTIVE ORGANIZATION CHANGES AT OWENS-ILLINOIS GLASS

Organization changes affecting executive assignments at Owens-Illinois Glass Company were announced by Carl R. Megowen, president.

Alexander M. Turner, O-I vice president in charge of personnel administration since 1953 was appointed general manager of the Libbey Glass Division. Mr. Turner's career at O-I began as a student in the Charleston, West Virginia plant in 1934. He was named manager of the Gas City, Indiana plant in 1941 where he served for five years, then followed seven years of duty in the Pacific Coast Division as manager of the Oakland, California plant, then he served as divisional vice president and general factories manager until his return to Toledo in 1953. He succeeds Harry J. Durholt who has been the Libbey Glass Division's general manager since 1949.

W. J. Stewart

H. J. Durholt

Mr. Durholt continues as a vice president of the company and has transferred to the administrative division where he wil serve in an advisory capacity as a consultant to Hugh C. Laughlin, executive vice president. Mr. Durholt joined the Libbey Glass Company, now a division of Owens-Illinois, in 1918 as a machinist.

William J. Stewart was named director of personnel administration to succeed Mr. Turner. Mr. Stewart also continues as general manager of the Kaylo Division, in which capacity he has served since 1953. At a later date Mr. Stewart will announce the appointment of his successor as chief industrial engineer of the administrative division of the company, a position he has held since 1949.

Like Mr. Turner, Mr. Stewart joined Owens-Illinois at the Charleston, West Virginia plant.

● John V. Higgins, branch sales manager in Los Angeles for Libbey Glass, Division of Owens-Illinois, has been promoted to western regional sales manager. He will be responsible for the operation of Libbey's branches in Los Angeles, San Francisco, California and Seattle, Washington.

Inventions and Inventors . . .

(*Continued from page* 34)

perature of the surface is reduced, a relatively lesser amount of film will be deposited. Thus, the film is of gradual diminishing or decreasing thickness outwardly from the phantom lines shown in Fig. 3 to the ends of the glass sheet 16, in direct proportion to the convergency of the end portions of the electrodes 14 and 15. Therefore, in these areas, which lie between the rounded tips of the electrodes 14 and 15, a relatively lesser amount of current will flow across this path of relatively higher resistance, a lesser amount of heat energy will be developed in these areas and at the electrode tips, and consequently, hot spots and areas of relatively greater heat concentration will be substantially eliminated.

The patent contains seven claims and the following references were cited: 2,330,202, Brennen, Sept. 28, 1943; 2,429,420, McMasters, Oct. 21, 1947; 2,478,817, Gaiser, Aug. 9, 1949; 2,522,531, Mochel, Sept. 19, 1950; 2,569,773, Orr, Oct. 2, 1951; and 2,570,245, Junge, Oct. 9, 1951.

A. J. MARTIN JOINS GCMI AS LABOR RELATIONS DIRECTOR

A. J. Martin has been named labor relations director of the Glass Container Manufacturers Institute, Inc., succeeding the late Ralph A. Lind, according to an announcement made by Victor L. Hall, GCMI's general manager.

Mr. Martin has been associated with the Owens-Illinois Glass Company and its predecessor, Owens Bottle Company, for more than forty years. He has been the Company's director of labor relations since 1949.

Mr. Martin, who would normally have retired from Owens-Illinois on November 30, 1956, will, effective December 31st, 1955, resign his present post and assume his new duties with GCMI immediately thereafter.

In addition to handling labor relations for the Glass Container Institute, he will also act as director of labor relations for the National Association of Manufacturers of Pressed and Blown Glassware. The two associations, whose members have over 100 plants located throughout the country, bargain on an industrywide basis with the Glass Bottle Blowers Association and the American Flint Glass Workers Union.

FORREST BRANCH APPOINTED BY AMERICAN POTASH

American Potash & Chemical Corporation has announced the appointment of Forrest Branch to the newly created position of director of Administrative Services for the company, its subsidiaries and divisions. The appointment is effective December 1, according to R. B. Coons, company vice president, who made the announcement.

Mr. Branch has been manager of Administrative Services at the company's main plant at Trona, California, about 175 miles northeast of Los Angeles. He will transfer from Trona to company headquarters at Los Angeles some time after the first of the year.

GEORGE F. WILLIAMS APPOINTED A DIRECTOR AT KIMBLE GLASS

The appointment of George F. Williams as director of technical products development for Kimble Glass Company, subsidiary of Owens-Illinois, has been announced by F. D. Pinotti, Kimble vice president and chief engineer.

Mr. Pinotti said Mr. Williams' primary responsibilities will be in connection with the development of products and processes for manufacturing items from borosilicate glasses.

Mr. Williams started with Kimble early in 1955. Nearly all of his experience, after graduating from Ohio University has been in the glass industry. He has spent 22 years with some of the largest glass companies in the country.

BALL BROTHERS APPOINTS DR. KENNETH C. LYON

Appointment of Dr. Kenneth C. Lyon, former chief of glass research for the Armstrong Cork Company, to the position of manager of Glass Research and Product Development for the Ball Brothers glass container manufacturing firm was announced recently, by R. A. Gaiser, director of research and product development.

Dr. Lyon was with the glass division of Armstrong Cork for 14 years, first as chief chemist at their Millville, N. J., glass container plant; from 1946 to 1954 he was in charge of glass research at the Armstrong Research Laboratories, Lancaster, Pennsylvania.

Dr. Lyon is a Fellow and vice president of the American Ceramic Society and a member of the Division of Chemistry and Chemical Technology National Research Council. He holds three degrees from the University of Illinois. He served 14 years as a member of the Testing Procedures Committee, Glass Container Manufacturers Institute; 10 years as chairman of the Glass Committee, American Society for Testing Materials, and is a former chairman, Glass Division and former trustee of the American Ceramic Society.

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Colmonoy hard-facing alloys are stretching the useful life of many fast wearing parts in the glass container industry. They resist abrasion and heat. They are applied in several ways: as castings, oxy-acetylene rods, and powder which is sprayed and welded in the Colmonoy Sprayweld Process. Shown here are some typical Colmonoy applications. to help solve problems like these in your plant, write for our data sheets and other literature.

Here a plunger is being hard-faced with the Colmonoy Spraywelder, using Colmonoy No. 4 alloy powder. The Spraywelder provides a perfectly controlled method of applying an even overlay of wear resistant alloy. Three grades of Colmonoy alloys are available for Spraywelding.

Many types of glass plungers can be hard-faced with the Colmonoy Spraywelder, using Colmonoy nickel-alloy powders. Air-cooled press-and-blow plungers (pictured) that once lasted only 5 hours, now last more than 200 hours after hard-facing. Request Engineering Data Sheet No. 34.

Colmonoy No. 20 is now the accepted material for repairing glass moulds, neck rings, and related cast iron parts. Chipped areas, surface cracks and flaws are all easily filled and refinished with Colmonoy No. 20 oxy-acetylene rod. Request Engineering Data Sheet No. 36.

Thimble inserts made of cast Colmonoy No. 4 or 20 last up to three times as long as do the cast iron thimbles alone. Inserts in a wide variety of sizes are available from stock. Easily machined to exact size, they are press fitted into place. Request Engineering Data Sheet No. 42.

Other Colmonoy Applications

PART	ALLOY
Cullet Chutes	Colmonoy Sweat-on Paste fused by oxy-acetylene flame
Cullet Hammers	Colmonoy No. 1 electrodes
Timing Buttons	Colmonoy No. 6 oxy-acetylene rod
Blowheads	Colmonoy No. 4 Sprayweld
Baffles	Colmonoy No. 4 Sprayweld

If your "problem part" isn't mentioned here, tell us what it is, along with pertinent information as to what kind of wear, temperature, conditions, etc. are encountered.

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K. Conrad

R. R. Denman

KEITH CONRAD AND ROBERT DENMAN PROMOTED AT O-I

Promotion of Keith Conrad to chief engineer, Pacific Coast Division of Owens-Illinois Glass Company, has been announced by E. R. Owens, division general factories manager.

Mr. Conrad, who has been with Owens-Illinois since 1946, will be succeeded as chief project engineer of the General Research Department at the company's Technical Center in Toledo by Robert R. Denman, who moves up from process development engineer for O-I's subsidiary, Kimble Glass Company. The promotions are effective January 1.

JOHN H. HENSHAW ELECTED PRESIDENT OF NEWLY ESTABLISHED PITTSBURGH PLATE DIVISION

Pittsburgh Plate Glass Company has established a new wholly-owned subsidiary to be known as the Pittsburgh Plate Glass Export Corp., according to an announcement by Harry B. Higgins, president.

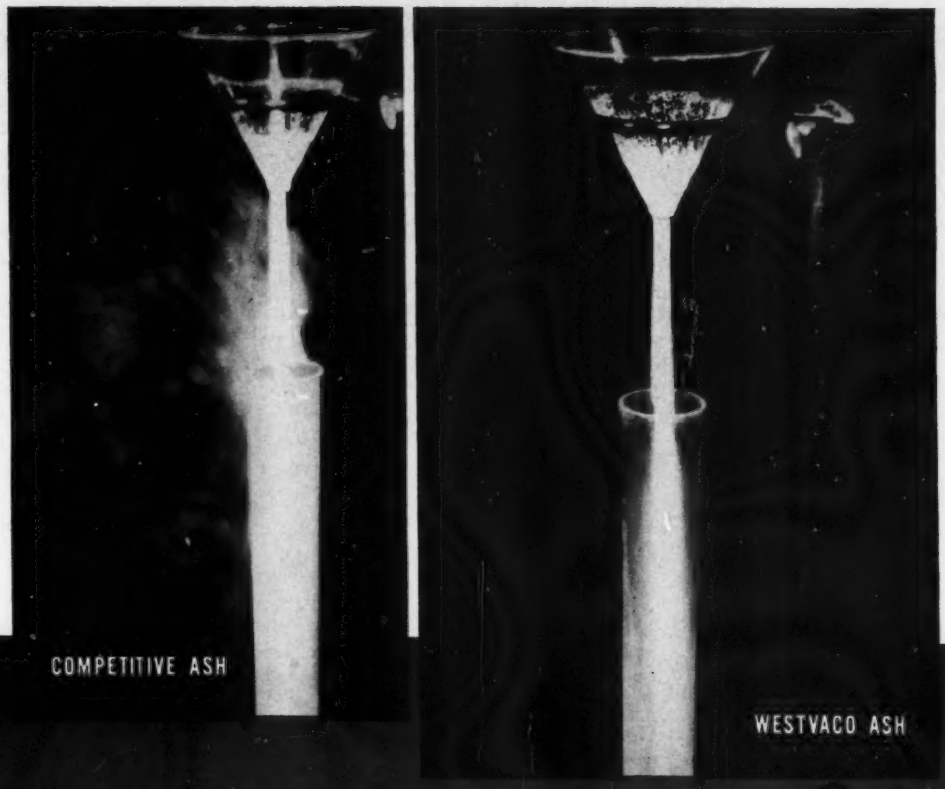
Purpose of the subsidiary is to handle all phases of the export business of Pittsburgh Plate Glass Company within the western hemisphere.

Export operation outside the western hemisphere will, however, continue to be handled by Pittsburgh Plate Glass Company, according to Mr. Higgins.

President of the new subsidiary is John H. Henshaw, who will continue to serve as general export manager of Pittsburgh Plate Glass Company.

Other officers are Sidney W. Dodge, vice president; C. R. Fay, comptroller; W. V. Simmons, treasurer; John G. Fleming, assistant treasurer and Charles R. Pascoe, secretary. Directors are Mr. Henshaw, Mr. Dodge, Mr. Fay, R. B. Tucker, P. A. Ketchum, R. F. Barker and E. W. Haley.

● The Pittsburgh Corning Corporation announces the appointment of Philip D. Shea, Jr. as sales representative attached to the company's Philadelphia District Office.



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Additionally, the needle-like crystals of Westvaco Soda Ash do not have the autogenous pulverizing action common to isometric crystalline materials.

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COLUMBIA-SOUTHERN ANNOUNCES EXECUTIVE APPOINTMENTS

W. I. Galliher, vice president and director for Columbia-Southern Chemical Corporation, has announced his retirement, effective December 31, according to E. T. Asplundh, and Chris F. Bingham, formerly director of sales, has been appointed vice president-sales, succeeding Mr. Galliher.

Other executive changes, effective January 1, include the appointments of H. W. Gleichert, as vice president-market research and development; W. F. Newton, as director of sales, and P. A. Fodor, Jr. as assistant director of sales.

Mr. Galliher terminates an illustrious sales career which began as director of sales for the Columbia Chemical Division of Pittsburgh Plate Glass Company in 1930. In 1947 he was appointed executive sales manager for both Columbia Chemical and Southern Alkali Corporation, a Pittsburgh Plate subsidiary. Mr. Galliher has served as vice president of sales for the Columbia-Southern Chemical Corporation since 1951. His retirement climaxes a distinguished service in the chemical industry.

Mr. Bingham served as director of sales since 1953, prior to his appointment as vice president-sales. He joined Columbia-Southern as a technical service engineer and during his 15 years with the company has held various supervisory sales positions. In 1945 he transferred from Philadelphia to the Pittsburgh office as manager of pigment sales and seven years later became assistant director of sales.

Mr. Gleichert had served as assistant to the vice president of sales since 1951 prior to his appointment. He joined the firm's Barberton, Ohio, plant as assistant chief chemist in 1920, and later held sales and technical service positions there until his appointment as assistant director of sales for the Pittsburgh, New York and Barberton in 1937. He was named director of sales in 1945.

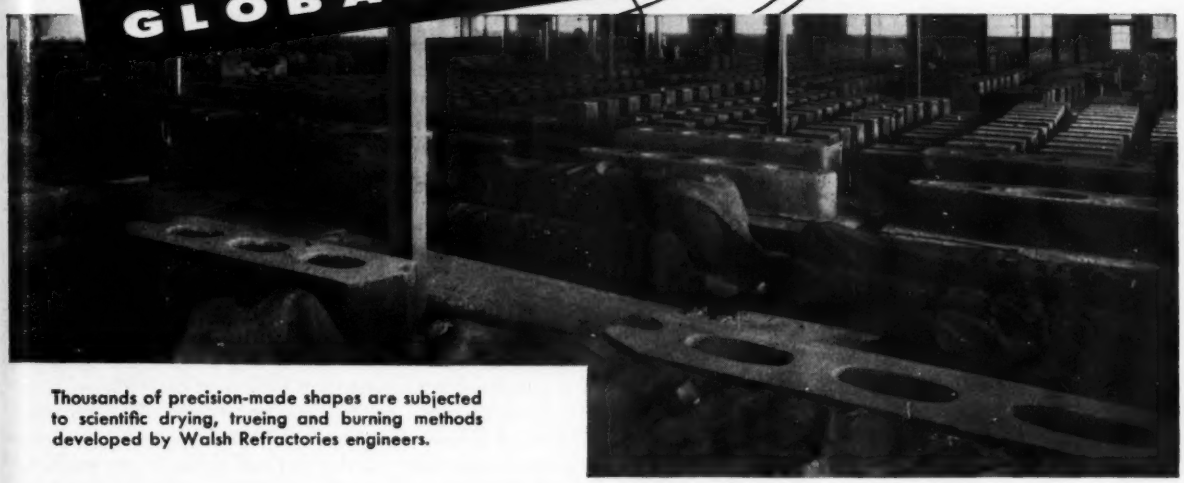
CARBORUNDUM ANNOUNCES EXECUTIVE APPOINTMENTS

Leslie E. Simon, Major General, U. S. Army, retired, formerly assistant chief of ordnance for Research and Development of the U. S. Army Ordnance Corps, has been appointed director of the Research and Development Division of The Carborundum Company, according to an announcement by Clinton F. Robinson, president of the company and Harry C. Martin retires from the position of director of Research and Development after serving with the company for 42 years. Mr. Martin will continue as a vice president of the company, handling special assignments for the president.

Dr. Wingate A. Lambertson, formerly assistant director and professor of silicate chemistry of the Institute of Silicate Research for the University of Toledo, has been appointed assistant to the manager, Research Branch of the Research and Development Division of the Carborundum Company.

Dr. Lambertson has a broad background in the field of refractories, high temperature chemistry and ceramic materials for nuclear reactors. He will be responsible to expedite the flow of information on Carborundum laboratory developments to potential customers with emphasis on military and atomic energy applications of ceramic materials.

GLOBAL ACCEPTANCE



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The Glass Industry—1955 . . .

(*Continued from page* 23)

the tubes sold in 1954, over 76 percent were 21 inches or larger.

Color Television

Of the 530 television stations in operation in 1955, more than 265 are equipped to transmit network color programs. It has been estimated that about 200,000 color receivers were sold during 1955.

The new color tube has a picture area of 250 square inches—nearly 22 percent more viewing area than that of any other color picture tube now on the market. The retail price of the new color receiver is about $900, and its cost is about equal to the cost of three black-and-white receivers.

In addition to big-screen pictures a new 21-inch kinescope offers set manufacturers and owners such advantages as the following:

(1) Excellent color-picture brightness, contrast, and fidelity which match the picture quality of comparable-size black-and-white kinescopes.

(2) Short tube length which will facilitate the design of compact television cabinets. Despite its considerably increased picture area, the 21-inch color tube is actually shorter in overall length than the 15-inch kinescope.

A unique engineering feature of the tube is a curved shadow mask which is principally responsible for the tube's excellent color brightness and fidelity. It can absorb, without distortion, more power input than any other type of mask.

The tube's metalized screen is an array of more than one million small, closely spaced phosphor dots on the inner surface of the tube's filterglass faceplate. The dots are arranged in triangular groups, each containing a red, green, and blue dot. The curved shadow mask, containing more than 350,000 tiny holes, is mounted immediately behind the tube screen, with each hole aligned with a particular trio of dots on the screen. The electron beams produced by the tube's three electron guns must pass through each of the 350,000 holes in the mask to strike and activate the phosphor dots in each triangular group.

The shadow mask's unique thermally compensated action enables it to expand under the bombardment of the electron beam in such a manner that each of the 350,000 holes remains in alignment with its particular trio of red-green-blue dots on the tube screen. This constant alignment assures color purity.

A 22-inch rectangular glass bulb for color television picture tubes is also available.

The 22-inch rectangular unit is expected to become a standard for the industry. Besides the advantages of large viewing area and rectangular shape, the bulbs offer the fundamental cost advantage of glass units.

The new tube is approximately the same length and height as a 19-inch round bulb and is designed to fit into the same size cabinet. It is designed for a shadow mask tube and is constructed so that the mask can be mounted by either of the two methods now in use—the flat land or the pin method. The bulb is adaptable to either the three-gun or single-gun system, the two major systems for color television.

Color television is now bringing the whole industry to a new cycle of growth. The initiative must be taken as well as a willingness to take great financial risks for pioneering a new development. A major producer in the field is said to have spent fifty million dollars in pioneering black-and-white television to the commercial stage, and an equal amount will be spent on color television before any profits are realized.

VIII. Electric Lamps

The lamp industry in the United States produced an estimated two and one-quarter billion lamps in 1955. These are divided by types as follows: Fluorescent, 90,000,000 units; incandescent, largely household sizes, 975,000,000; photographic, 500,000,000; miniature, 380,000,000 and Christmas lamps 295,000,000. This production volume has an estimated retail value of $700 million.

IX. Lithium Supply Grows

Broadening use of atomic energy and intense industrial promotion continue to raise the requirements and demands of lithium raw materials. Commercial requirements of lithium chemicals for 1955 have been estimated at 9 million pounds with lubricating grease and ceramics each accounting for about 3.5 million pounds. Actual domestic production has been carefully shrouded in secrecy but it would appear that under the stimulus of atomic energy and Government support the supply is greatly improving. Substantial improvements in efficiencies in new plants have been made and improved flotation mills mean higher lithium concentrates.

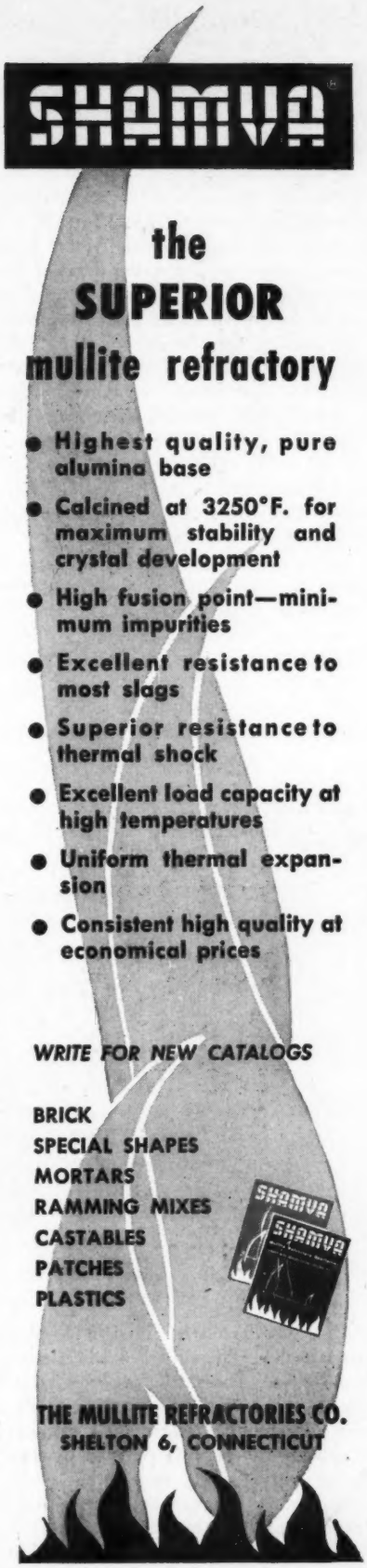
At present the Foote Mineral Company produces about 40% of the industries capacity. Its efforts are largely concentrated at the Sunbright plant which has been under continuous construction since 1952. No sooner was the first plant finished than another round of construction designed to more than double the plant capacity was begun. Construction delays and piping foul-ups have lengthened the program. Capital expenditures are expected to continue in 1956 at the current year's rate of $3 million.

The Bessemer City, North Carolina plant of the Lithium Corporation of America charges spodumene ore of 1.4% lithia direct to process without intermediate concentration and enjoys very good over-all efficiency and yield. Even though the plant has not as yet attained capacity operation, processing costs are indicated to be substantially under those figured for design operation.

Limited to by-product output of about 1.5 million pounds at Searles Lake, California, the American Lithium Chemicals, Inc., jointly owned by American Potash & Chemical Corporation and Bikita Minerals (Pvt.) Ltd. has constructed a $6.6 million lithium chemicals plant at San Antonio, Texas, to process lepidolite ore imported from Rhodesia. The plant was scheduled to begin operations the latter part of 1955, utilizing a relatively new process. This company will provide an estimated 25% of industry capacity.

An expansion of lithium consumption in new areas of the glass industry can be visualized also in such outlets as lithium hypochlorite dry bleach, lithium fluoride, or

(*Continued on page* 48)



The Glass Industry—1955 . . .

(*Continued from page* 47)

carbonate as an additive for aluminum production in the bauxite-cryolite bath, and as an intermediate chemical for the manufacture of boron hydrides.

X. Future Possibilities

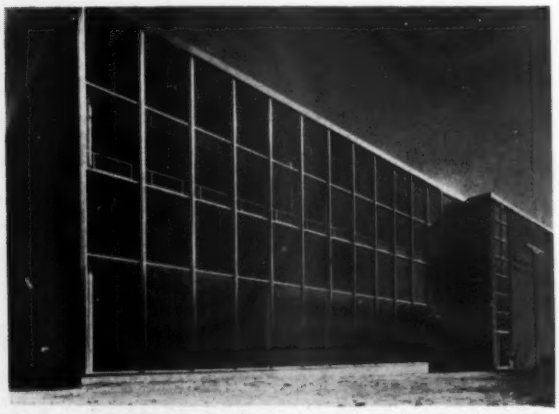
Glass, one of mankind's oldest manufactured products, is now being produced, sold, and used at a record-shattering rate. Chief reasons are the booms in building and automobile output, an increasing demand for glass containers, continued growth in the electronics industry, and the constant expansion of the glass fiber field.

Complementing these reasons is the desire for more glass per unit in residential and business structures and in automobiles. The demand for more and better glass in automobiles has been met, but that for building units has not. Thus, the big producers are now concentrating on the building field. The largest producer of glass fiber has put $60,000,000 into production facilities in the last ten years. The future of the glass fiber industry is to a large degree incalculable.

New electronic devices that may alter common aspects of living in the near future have been described.

An electronic sound-synthesizing device that can, in theory, duplicate exactly any sound, including any musical sound and any voice. In addition, it can synthesize sounds that have never on earth been heard, literally bringing to man the music of the spheres.

An electronic cooling device in which six ounces of ice have been frozen has been developed. This accomplishment is believed to be the first instance of a freezing temperature having been attained, in a sizable area, without mechanical refrigeration accomplished by motors and compressors.



Modern use of glass walls. *Courtesy Pittsburgh Plate Glass Company.*

In other areas the electronic light amplifier may be expected to lead to devices which will make vision possible in darkness. These will add greatly to the safety of transportation on land, at sea, and in the air. The perils of night driving, too, are likely to be reduced and perhaps abolished by such electronic devices providing far-reaching light without glare.

In short, the sky is the limit in imagining the future of electronic light. The one certainly is that, like other major scientific innovations in the past, it will open roads to improvements on existing products and processes, and will give birth to entirely new instruments, appliances, and services.

A first benefit from research will be the bigger and brighter television pictures in the home. It is possible that the TV tube of today will eventually be eliminated. It will be displaced by a thin, flat screen like a picture on the wall or it may be an easel-like frame that will sit on your livingroom table, and being portable, can be moved to any other part of the room or house. If desired, the same program could be received on a number of screens in different rooms of the house.

The pictures could be controlled from a little television box no bigger than a jewel case or cigar box. No cabinet will be required. The television box will contain all the controls—tuning, volume, light, station selector—and a knob will enable the viewer to make the image larger or smaller, and in black-and-white or in color, to suit the eye and the mood. Glass will continue to play a major role in these developments.

EXPANSION OF FOAMGLAS PRODUCTION ANNOUNCED BY PITTSBURGH CORNING

J. P. Staples, executive vice president of the Pittsburgh Corning Corporation, has announced that the company will expand production of Foamglas cellular glass insulation at its Port Allegany, Pa. plant by 50 per cent.

Additional melting and processing equipment, at an estimated cost of $1,250,000, will be installed in existing buildings. This will include a much larger continuous melting furnace, two roller hearth furnaces, two lehrs, ball mills, trimming machines, dust collectors, etc.

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Sixteenth Conference . . .
(Continued from page 28)

creased use of double gobbing increases efficiency of machines, balances furnace output, makes better use of lehrs and provides more efficient inspection and packing.

The 6-section machine provides a theoretical increase of twenty per cent in productive capacity but in actual use often produces a greater increase.

The new six-foot wide lehr includes a number of improvements such as more accurate temperature control, provision for automatic thermal shock and for coating of bottles to protect them in automatic handling.

The thermal shock unit makes it possible to perform a hundred per cent testing of the bottom and lower side walls of a large variety of containers including both jars and bottles. In addition to eliminating defective ware, it has been found to aid machine operation by pointing out defects on a systematic basis.

Automatic inspection for checks in the finish in certain types of jars is being done regularly and the extension of automatic inspection to checks located in other parts of containers is in a favorable development stage.

Development is well along toward automatic pressure testing for certain types of ware. Commercial trials are soon to be evaluated.

The years 1953-1955 represent a period of steady growth in the Glass Container Industry. In 1952 the production of glass containers seemed to have reached a plateau of about 115 million gross per year. Actually, 1953 saw production of 129 million gross and 1954, 127 million gross. The production for this year (1955) should exceed 130 million gross. The statistics point to continued growth of the glass container industry, both in proportion to increase in populaton and as a result of entering new markets. Glass containers are of better quality and greater serviceability than ever before and the industry is striving to produce an even better product.

Progress in the Use of Silicones in the Glass Industry. *By John A. Stapp, Linde Air Products Company, Division of Union Carbide and Carbon Corporation, Tonawanda, New York.*

Progress in the use of silicones in the following applications was covered: lubrication of blank molds and/or delivery equipment of automatic glass container forming machinery and the use of silicones as surface coatings.

Application of silicones to delivery equipment has increased materially during the past year while the application of silicones to blank molds has been slower, due to both technical and psychological factors. The advantages cited for silicones over conventional lubricants were: lack of smoke, cleaner molds and delivery equipment, cleaner ware, possibility of increased production and percent pack. A long range benefit to be derived is lower insurance rates because of the decreased fire hazard.

Surface coating of bottles with silicones is expanding greatly as the customer becomes more cognizant of the advantages of silicone treated ware. Silicone treated ware is characterized by a very slick, invisible surface, highly resistant to scratching. Therefore, bottle strengths are maintained and less breakage occurs on filling lines. Various silicones available for this type treatment and the economies involved were discussed.

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Directly and indirectly, Calumite is helping manufacturers of amber ware to increase their profits.

From the production viewpoint, Calumite insures greater glass stability, easier melting and increased production. Added values are found in diminished superstructure attack and stone loss, considerably reduced volatile attack and batch carry-out and longer checker life and furnace efficiency, all *directly* aiding in improving profits.

***Indirectly*, Calumite helps to increase profits by increasing the percentage of ware packed and through improved quality enhancing the saleability of your ware.**

Help yourself to increased profits now!

The Calumite Co.
HAMILTON, OHIO

Seeds and Fining . . .

(*Continued from page* 29)

tremely high seed count and poor striae quality. Very short melting time at high temperature and long fining time at low temperature seems to give the best results. It is not unusual to have this type of glass to dissolve as much as one to two per cent of the pot in a period of twenty-four hours. The fact that there is always a preponderance of seeds at the glass refractory interface is indicative of the extreme corrosiveness and the release of gases by the refractory when going into solution. This glass is used principally for photographic lenses. Early manufacturers of this glass had so much difficulty with seeds, that they convinced the users of photographic optics that every good lens must have bubbles in it.

Flint glasses (lead) have fewer seeds than almost any other type of optical glasses. High melting and fining temperatures may be used to advantage. There is not the reaction between the glass and pot that is so pronounced in the barium glasses. The viscosity is much higher in flint glasses at their melting temperature than in most any of the other optical glasses. Despite this, the seeds do not have as much difficulty in rising to the surface and being released. It is assumed that the small amount of pot attack is responsible for this.

Fining is the process by which the molten glass approaches freedom from undissolved gases. Since seeds are extremely small gaseous inclusions in glass, it follows that very low viscosities are a requisite to allow the gases to rise to the surface. Some manufacturers of optical glass still use the "blocking" method. This is usually in the form of plunging a water soaked piece of wood down into the melt of glass. The sudden evolution of steam is so violent that the large bubbles formed agitate the glass and carry many of the small seeds along with them to the surface of the melt.

A few refining agents used in the batch, some of which must be used in combination with nitrates are:

(1) Arsenic
(2) Antimony
(3) Cerium—no arsenic or antimony present
(4) Barium Sulphate
(5) Calcium Sulphate
(6) Sodium Sulphate—not more than 1.5% as sodium oxide
(7) Sodium Chloride } maximum 1% .6 NaCl
(8) Fluorine } .4 F
(9) Barium Peroxide
(10) Magnesium Chloride—in place of NaCl
(11) Sodium titanium silicate up to 2%

Cerium with arsenic or antimony will cause a slight yellowish color on exposure to sunlight. Care should be exercised in the use of some of the above mentioned salts. In several crown glasses sodium chloride was used as an aid in refining. The damage to moulds in the subsequent pressing operations was so great that other fining aids had to be used.

Tremendous strides that have been made in optical glass manufacture within the last fifteen years have been responsible for completely new standards on quality. The first successful all ceramic continuous furnace for the manufacture of optical glass was in operation at Bausch & Lomb in 1948. It was a combination gas and electrically heated furnace using the glass as a resistor. All of this work was stimulated because of the desire to improve seed and striae quality.

In recent years, platinum has been used extensively in continuous optical glass tanks. It seems most practical to melt the batch in chambers having electrocast refractory and fining and homogenizing in platinum sections.

The use of platinum allows us to use extremely high temperatures up to a maximum of 2750° F. (1510° C.), if we wish, without the fear of contamination. It will be recalled that in making Dense Barium Crown glass, it was a never ending cycle in using high temperature to finish the glass but the higher the temperature the more the crucible went into solution, thereby causing more seeds to enter the melt.

An important contribution that has been made to the fining of optical glass has been a procedure that has been in use in the manufacture of fused quartz for a good many years. Transparent fused quartz was made by melting natural brazilian quartz in graphite cylinders and bubbling hydrogen from the bottom. This permits the air entrapped between the small quartz particles to be carried by the hydrogen through the viscous mass to the surface and then released.

There has been very strong evidence that Barium glasses in particular have tremendous amounts of dissolved gases. With the simple procedure of bubbling air or other gases through *shallow* depths of glass, astounding improvements have been made in seed quality. Just an indication of this improvement is a Baryta flint glass, that for years averaged approximately twelve seeds per ten cc. when made in clay pots which today is being made in a continuous tank by the tons, that has less than .004 per ten cc. The best performance in making this glass occurred when fifteen hundred pounds was inspected and there were indications of only one bubble having a diameter of about two thousandths of one inch in diameter.

Some crown and flint glasses do not need to be subjected to bubbling because the extremely high temperature permissible in platinum is sufficient to allow the seeds to escape.

Optical quality glass is now being supplied in almost all ophthalmic lenses.

I believe that there is a practical application of the use of platinum and bubbling of gases that will be of tremendous help to any manufacturer of glass, be it in the flat, container or tableware phase of glassmaking.

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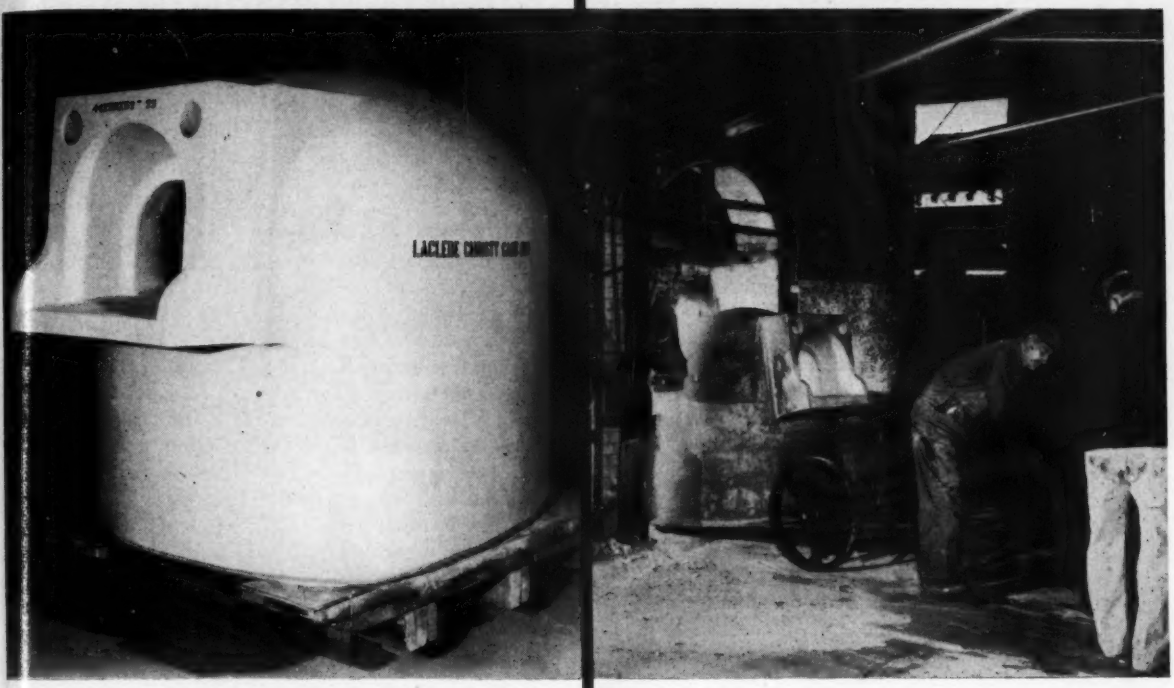

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GCMI Meets in Miami

(*Continued from page* 30)

day, shipments of these bottles are back to about the 1939 level. Meanwhile, products that were unknown or unimportant in 1939 are consuming glass containers at an annual rate, probably well over 30 million gross.

"The competitive prosperity that is likely to characterize our country through the end of this decade will provide many further opportunities for growth in glass container consumption," Mr. Merrifield concluded.

Despite the growing demand for glass packed products, the glass container industry is not resting on its laurels but will continue to aggressively promote its products through its marketing research committee, headed by R. L. Chenney and with the able assistance of the Institute's agency, Kenyon & Eckhardt, Inc.

Mr. Blunt in touching upon competitive packaging materials, paid tribute to the dynamic campaign initiated by the glass container industry in May 1954. This campaign has done much to combat the competition and develop greater public acceptance for glass packed merchandise. The program will be continued at an accelerated pace.

In matters relating to labor relations, it was stated that 1955 had been the biggest year since 1946 in terms of increases in cents-per-hour cost for labor.

Commenting on the work of the Committee on Package Design and Specifications, Mr. Blunt stated that one basic accomplishment has been the designing and development of an instrument known as "Dynamic Cushion Tester" for corrugated board. It is felt that this new development will be well received by the paper board industry and that the instrument will also fill a need long felt by the glass container industry.

Regarding the Committee on Testing Procedures, it was reported that for the first time in four years it has a full complement of personnel engaged in this work at Preston Laboratories in Butler, Pennsylvania. So great has been the demand by American industry for young scientists, that it actually has taken several years to find capable manpower for this important work.

Mr. Blunt in referring to the work of the Technical Committee on Glass Packed Products emphasized the industry's part in the nuclear experiments headed by Dr. John M. Sharf. He stated "I am sure Dr. Sharf's report will make evident the importance of this effort, not only in protecting, but in enhancing the reputation of glass as a container material."

Concerning the work being carried on under the fellowship at the University of Massachusetts, Mr. Blunt stated while it is in a somewhat similar category, much of it involves the development of proper processing methods. As an example, for the first time, glass packers are furnished with complete scientific data as to processing times and temperatures for the various style of pickles.

In relating the activities of the Subcommittee for Public Education, Mr. Blunt said, "All of us are proud of the products that we manufacture. Glass containers add greatly to the convenience and graciousness of living. Unfortunately, everyone does not share the high regard for our products that the majority of the public and we do. Sometimes our bottles are thoughtlessly discarded in public places such as along highways. The relatively few people who are careless in their habits have brought about an attitude of hostility toward glass by farm groups, garden clubs, and the like that is unwarranted. Sometimes this hostile attitude has taken the form of proposals for punitive legislation against the container manufacturers.

"There is a long-range job ahead to convert hostile attitude to one of understanding and also to combat proposals from any source that will hamper or restrict in any way the use of our products. In short, that is the important job that has been assigned to the Subcommittee for Public Education.

"All of us, I am sure, are grateful for the time and guidance that Smith Rairdon, chairman of the Subcommittee for Public Education, has been able to give this important activity."

In further recognition of this problem the Trustees recently authorized an addition to GCMI and as of mid-October, George Fremault joined the staff to assist Harry Kuni in carrying out the program of the Committee for Public Education. He has had extensive experience as a newspaper man and in the field of public relations.

Another aspect of this committee's operations is cooperating with the program of Keep America Beautiful, Inc. Mr. Rairdon has accepted a second term as president of this organization.

As is customary at all GCMI meetings, social activities were not overlooked. Included were the cocktail party, this one sponsored by the Buck, Diamond and Liberty Glass companies, the GCMI banquet, and golf.

It was announced that the Fall 1956 meeting is planned for the Phoenix-Biltmore, in Phoenix, Arizona.

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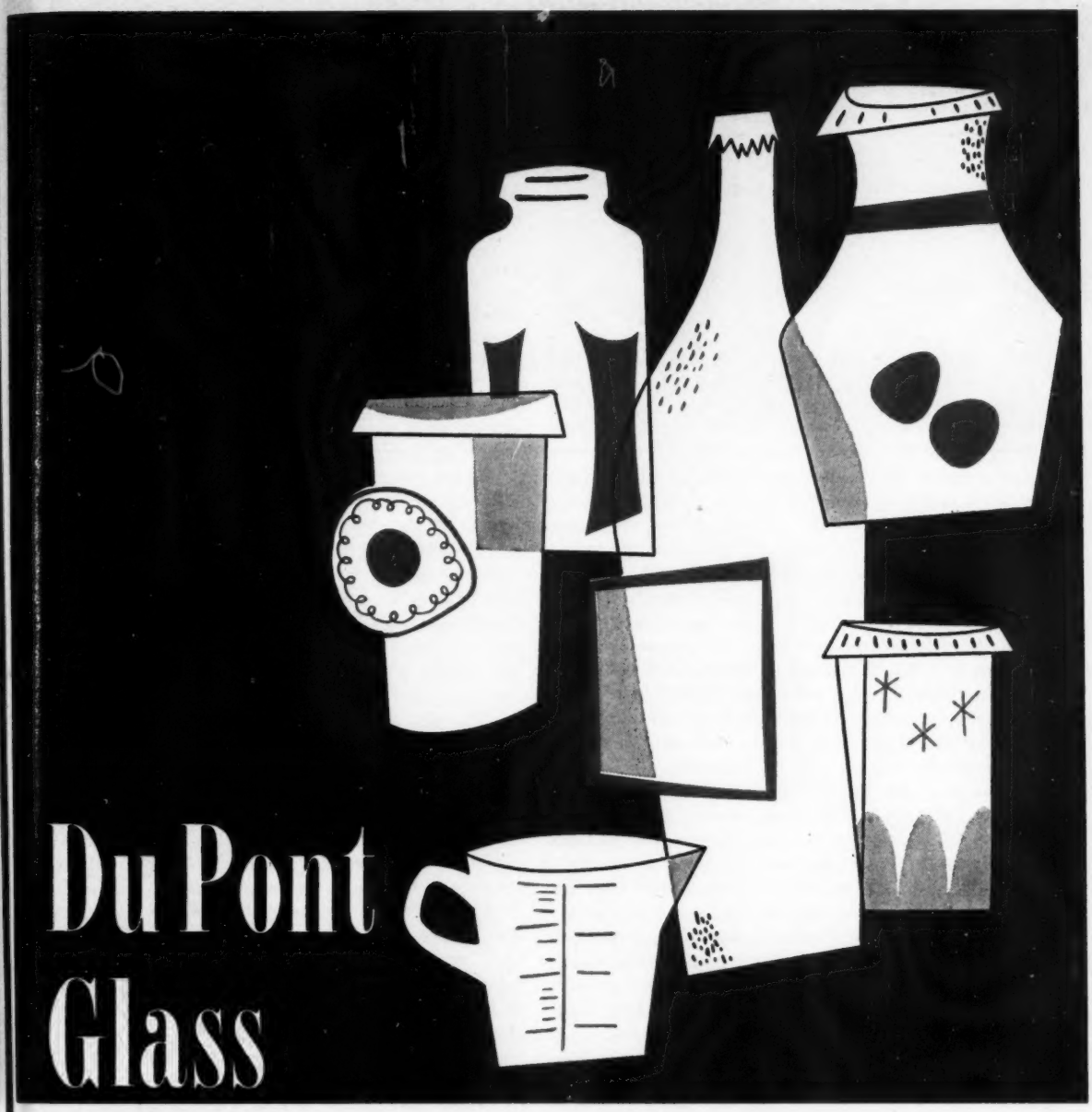

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(*Continued from page* 31)

of operators have expressed a preference for making measurements at this point.

Table III
Automatic Temperature Control

	Tank Furnaces		Pot Furnaces
Considered to be both feasible and advantageous	8		—
" " " feasible but not sure whether advantageous	2		—
Considered to be feasible but not advantageous	2		2
Advantageous but doubtful feasible	3		—
Not sure whether feasible or advantageous	1		—
Considered to be neither feasible or advantageous	1		3
No experience or comment	—	—	—
	17	13	5

Measurement and Control of Pressures—Of the thirty-five firms replying, five used furnace pressure tappings in the crown, nine in the side or endwalls and three more used both positions. Of these, one preferred the crown, two the sidewall and one said that when the tappings were inserted through the side-wall then the tapping points should be only slightly above glass level. Some operators prefer to use two tappings, one at each side of the furnace, on the bridge covers or at the working end of the bridge. The remaining eighteen either used no means of checking furnace pressure apart from inspection of sting-out or, in a few cases, carried out occasional checks with portable instruments.

The views regarding automatic pressure control are given in Table IV. The main reasons suggested for adopting automatic pressure control were that it helps one to maintain proper gas and air ratio more easily. When adjusted to a given level considered most favorable it ensures minimum fuel consumption; it also ensures a regular melting rate and assists temperature control; it also compensates for uneven draft in regenerators due to blockage, weather conditions, etc. The main arguments against automatic pressure control are the costs of installation, maintenance and labor.

Table IV
Automatic Pressure Control of Furnaces

	Tank Furnaces	Pot Furnaces
Actually in use and completely in favor	6	—
In favor, but do not say if in use	5	—
Variable opinions in the firm, but do not say if in use	1	—
Not in use, but in favor and hope to install	1	—
Not in use, and definitely against	3	2
Not in use, and either dubious or no opinion	12	5
	28	7

Considering pressure measurements other than in the furnace chamber a large majority reported that recording or indicating instruments were used for the measurement of chimney draft (furnace side of the stack damper was considered the best location). The pressure of the gas at the valve or in the main was measured by some while one firm reported that this pressure was also automatically controlled. Regenerative furnace users measured pressures either regularly or occasionally at a variety of points including the top and/or bottom of the regenerators, flues, downtakes, etc.

Fuel and Air Measurement and Control—Twenty-six firms had experience in oil firing and the summary of the instrumentation of these installations is given in Table V.

Table V
Oil-Firing Equipment

Instruments for	No. of firms
Measurement of oil pressure	26
" " " atomizing-air pressure	23
" " " oil-preheat temperature	24
" " " atomizing-air flow	1
Indication of oil flow	21
Integration of oil flow	16

In the case of gas firing the replies included town's gas, coke-oven gas and producer gas usage. With producer gas the most common method was to measure the coal consumption by daily or weekly checks on the stocks, and to measure the gas pressure at the valve. For coke-oven gas or town's gas, pressure gauges and indicating, integrating and recording flow meters were commonly used. Gas-calorific value meters were also used by some. The presence of tar and dust in producer gas prevented many worth-while instruments from being used.

The opinion was that it would be advantageous to measure the secondary air flow to the furnace and this measurement was being carried out in a number of cases, an indicator being sufficient for the purpose.

On the question of whether automatic control of the fuel/air ratio is feasible or not the majority considered that such a control was practicable and that it had advantages in respect to fuel economy and furnace stability. It was suggested that automatic fuel/air control should be operated as an adjunct to automatic temperature control. Some felt that such fuel/air control would only be advantageous for liquid fuels, or controlled fuels such as town's gas, in view of the possible variability of composition of producer gas. It was found, however, that such control systems were being successfully used with producer-gas-fired furnaces.

Twenty-seven firms, including both tank and pot furnace users, were of the opinion that combustion checks were most desirable. Most used portable Orsat apparatus for analyzing waste-gas composition or as a means of carrying out occasional spot checks at different parts of the system. The recommended sampling positions varied from the base of the stack to the exhaust port or the exhaust-port downtakes. It was stated that to avoid any complications due to air inleakage the measurement should be made as close as possible to the furnace. Opinions differed about the use of CO_2 recorders. In the case of oxygen recorders the general reaction was that an oxygen recorder, if such instruments could be made for industrial conditions, would be the most valuable contribution which could be made at the present time.

Glass-level Measurement and Control—Twenty-three firms, all of which carried out some tank melting, were of the opinion that level control was important and the devices that were used for this measurement were many.

It was indicated that there was an active interest in the whole question of measuring and controlling glass level, the firms against, and in favor of, automatic control by linkage to the batch charging plant being more or less balanced in number.

ERRATA: In the November, 1955 issue, page 589 the formula was incorrectly stated. The correct version should read:

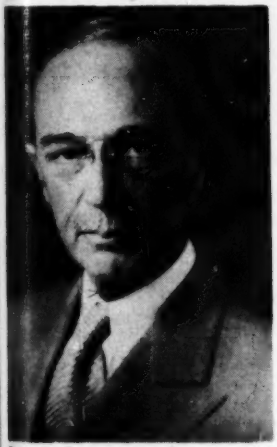
$$N = \frac{\text{Number of cations in extract}}{\text{Number } Si^{4+} \text{ in extract}} - \frac{\text{Number cations in glass}}{\text{Number } Si^{4+} \text{ in glass}}$$

EXECUTIVE CHANGES AT PITTSBURGH PLATE GLASS

Clarence M. Brown, chairman of the board of Pittsburgh Plate Glass Company since 1931, announced his retirement at a board of directors meeting. Mr. Brown was elected honorary chairman and will continue to serve as a member of the board of directors.

Harry B. Higgins, president of Pittsburgh Plate Glass Company since 1944, will succeed Mr. Brown as chairman of the board. David G. Hill, vice president in charge of glass manufacturing, was elected president of the company.

In another board action, the number of directors was increased from 11 to 12 and C. Robert Fay, vice president and comptroller, was elected to board membership.



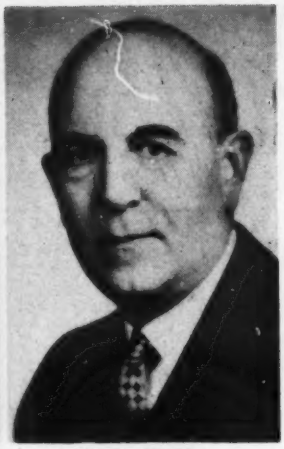
Retiring board chairman, Clarence M. Brown, is the proud possessor of one of the longest records of active service as an officer of a corporation in the industrial history of the United States.

He joined the company in 1895 as secretary and legal advisor to the late John Pitcairn, founder of the company and then chairman of the board of directors. He was elected a director in 1905 and has served continuously for 50 years in that capacity. During 1907, Mr. Brown was appointed general counsel and in 1922 was elected vice president. He has served as chairman of the board during the past 25 years.

Harry B. Higgins, new chairman of the board, has been associated with Pittsburgh Plate since 1905 when he joined the company as a stenographer at the Minneapolis branch following his graduation from Harvard University. During 1917, he was named manager of plate glass sales at the general offices in Pittsburgh. During 1928 he was elected vice president and chairman of the commercial department, was elected executive vice president in 1942 and president in January 1944.

Newly elected president David G. Hill joined Pittsburgh late during 1924 as an industrial engineer at the company's plate glass manufacturing plants at Ford City, Pennsylvania. He also served at the Crystal City, Missouri, and Creighton, Pennsylvania plants before being transferred to the glass manufacturing department in Pittsburgh in 1929.

D. G. Hill



H. B. Higgins

He was appointed general superintendent, plate glass factories in 1940 and elected vice president in charge of glass manufacturing during 1952 and a director of the company in 1954.

SOLVAY PROCESS ENTERS ITS 75TH YEAR OF CHEMICAL MANUFACTURING

Solvay Process Division, Allied Chemical & Dye Corporation, enters its 75th year of chemical manufacturing in 1956 with construction of its new hydrogen peroxide plant at Syracuse, New York completed, and with work on its new chlorine-caustic soda facilities at Brunswick, Georgia, well under way.

The hydrogen peroxide installation, which utilizes a new manufacturing process, is situated near the site of one of America's first chemical centers. It was at Syracuse that Solvay, founded in 1881, built this country's first soda ash plant.

Solvay's initial plant rapidly became the birthplace of many essential chemicals. Within a few years, caustic soda facilities were added, and chemical grade benzol and toluene production followed Solvay's construction of the first U.S. by-product coke ovens. Later came chlorine and chlorinated organic chemicals, as well as phenol. Syracuse was also the site of America's first synthetic ammonia plant.

In recent years a modernization and expansion program has taken place at Solvay's Syracuse works and new plants have been built in other areas.

An entirely new soda ash plant was completed this year at Syracuse, and Moundsville, West Virginia, became the site of a chlorine-caustic soda plant in 1953 and 1954 when Solvay entered a new field of chlorinated methane manufacture with completion of a plant for production of methyl chloride, methylene chloride, chloroform and carbon tetrachloride.

Servicing Solvay's customers and production units is the research staff and technical service section housed in the company's new research laboratory at Syracuse, New York. The company maintains a Technical Service Section manned by specialists who serve the glass, pulp and paper textile, cotton bleaching, and other industries.